University of Alberta

A COST CONSEQUENCES ANALYSIS OF A COMMUNITY-BASED ANTI-RETROVIRAL TREATMENT PROGRAM IN UGANDA

By

Wendy Beaunom

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ABSTRACT

This thesis presents a Cost Consequences Analysis of a community-based highly active anti-retroviral program in Rwimi situated in the district of Kabarole, Uganda. This relatively new way of delivering HIV/AIDS treatment by using volunteers and treatment partners is compared to the urban physician-centered model in Fort Portal, the capital town of Kabarole. The goals of this thesis are to gather information the socio-demographics profile of the patients, and the costs and outcomes in both models. The cost analysis reveals that from a societal perspective, the treatment cost is comparable in both models. The health outcomes are also comparable in both cohorts. Moreover, geographical accessibility is improved in the community-based model and the number of medical visits is also lower for the community-based project, reducing the burden on the health-care provider. These benefits in increased geographical accessibility and reduced health care utilization are important for developing countries.

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LIST OF ABBREVIATIONS

ARV	Anti-Retroviral
ART	Anti-Retroviral Treatment
CADTH	Canadian Agency
CBA	Cost Benefit Analysis
CB-DAART	Community-based Directly Administered Anti-Retroviral Treatment
CB-HAART	Community-based Directly Administered Anti-Retroviral Treatment
CCA	Cost Consequence Analysis
CEA	Cost Effectiveness Analysis
CIHR	Canadian Institute of Health Research
CMA	Cost Minimization Analysis
HAART	Highly Active Anti-Retrovirals
HIV/AIDS	Human Immuno Virus/Acquired Immuno Deficiency Syndrome
IQR	Inter quartile range
JCRC	Joint Clinical Research Center
JMS	Joint Medical Store
NMS	National Medical Store
PEPFAR	President's Emergency Plan for AIDS Relief
PMTCT	Prevention of Mother to Child Transmission

PPP	Purchasing Power Parity
TREAT	Time-Table for Regional Scale-up of ARV Therapy
UṢB	Uganda HIV/AIDS Sero-Behavioral Survey
USP	Uganda Sero-Positive Population
USh	Ugandan Shillings
UNAIDS	The Joint United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VCT	Voluntary Counselling and Testing
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

"Our material strongly suggests that by giving poor people more pragmatic support to manage household members living with HIV and AIDS, both stigmatizing actions and experiences are likely to decrease" (Bond, 2006)

1.1 The Problem in Context

Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) has profound economic and social impacts on countries where it is rampant. Economic impacts are particularly severe because the disease kills millions during their most productive years. According to a report by the Joint United Nation Programme for HIV/AIDS (UNAIDS) and World Health Organization (WHO) (2006), HIV/AIDS was responsible for an estimated 2.9 million deaths in 2006. Furin *et al.* (2005), in fact described HIV/AIDS as "the primary infectious killer of adults in the world today". Compounding the problem is the specific demographics that are affected the most by the disease: those with the least opportunity to access the means to deal with the disease - the "poor, the marginalized and the disenfranchised" (Furin *et al.*, 2005).

The magnitude of HIV/AIDS has made it a problem that lies well beyond the realm of the medical arena, effectively propelling it to the level of a development problem. For a long time, the only tool against this virus in the developing world was prevention. However, the increasing availability of cheaper generic drugs for poor countries has

created more development opportunities. In response to these opportunities, a number of initiatives have been launched including the 3 by 5 initiative by WHO, the Global Fund to Fight AIDS, Tuberculosis and Malaria, and the United States President's Emergency Plan for AIDS Relief (PEPFAR). Despite the tide of aid flooding the most affected regions consequently increasing access to treatment, Furin *et al.* (2005) still called for a "biosocial" solution to the problem:

> Understanding and managing AIDS in the world today means, fundamentally, understanding and managing it in a way that is cognizant of the social forces and factors that put people at risk of becoming infected with the disease and that make them sick once they have acquired it. (p.287)

A number of HIV/AIDS treatment programs that are based on a "biosocial" model have slowly mushroomed around the world, setting the trend for new generation medical treatments with strong community and social components. Community-based highly active anti-retroviral treatment (CB-HAART) programs belong to this innovative generation of anti-HIV/AIDS strategies. These programs involve volunteers, and treatment partners to monitor, and follow-up patients under treatment. For this reason, these programs are also known as community-based directly administered antiretroviral therapy or CB-DAART. This relatively new way of managing highly active anti-retroviral treatment (HAART) has at least two major types of benefits. First, in countries where doctors and other clinical staff resources are extremely scarce, community-based

programs offer the opportunity to improve access to treatment and to monitor patient progress including adherence to taking medication, thereby curbing the development of viral resistance to drugs. Second, by involving the volunteers and treatment partners from the community of the patients, stigma associated with the disease may decrease. De-stigmatization has been shown to increase voluntary counseling and testing (VCT) in countries such as Uganda (Okware *et al.*, 2001).

As new treatment programs are developed, questions of costs and effectiveness arise. The present study will compare the costs and consequences of two models of delivering treatment drugs through a Cost Consequences Analysis (CCA). One of the programs is the traditional urban clinic approach at the Joint Clinical Research Center (JCRC), which has been operating in Uganda for some time. The setting is the capital town of Kabarole district, Fort Portal. However, many patients (particularly poorer ones) do not have access to the urban clinic type of HIV/AIDS treatment, a standard HAART program with monthly patient monitoring in a modern state of the art facility. The second model represents the "biosocial" intervention described above, and is supported by our research project, which is a CB-DAART program. This intervention involves patients, clinical staff, and local volunteers in Rwimi, a rural Ugandan parish, in the Kabarole district. Volunteers and treatment associates are involved in monitoring patients on a weekly and daily basis, respectively.

1.2 Objectives of the Thesis

There is very little knowledge on the costs and consequences of CB-DAART in an African developing country setting. The aim of this project is to gather information on the costs and consequences of the community-based HIV/AIDS project, through a CCA. The objectives of the thesis are as follows:

1. Describe and compare the socio-demographic characteristics of the individuals in the rural and urban programs to assess:
    a. Whether the socio-demographic characteristics of the patients in the Rwimi cohort are different from the patients of the JCRC cohort, and how they both compare to individuals who has tested positive for HIV in Uganda;
    b. Whether the socio-demographic patterns of the patients uncover potential issues of interest to the operational management of the CB-DAART program at Rwimi;
    c. The characteristics of the treatment partners and volunteers involved in the Rwimi community-based project;
    d. Whether the socio-demographic patterns of the treatment partners and volunteers uncover potential issues of interest to the operational management of the CB-DAART program at Rwimi.
2. Perform a Cost Consequences Analysis
    a. Describe the costs associated with delivering both HAART programs;
    b. Describe the outcomes of both HAART programs;

c. Perform a sensitivity analysis.

1.3 Organization of the Thesis

The thesis is divided into 6 chapters. Chapter 2 develops the background and literature review. Chapter 3 explains our methodological approaches. Chapters 4 and 5 present our results and discussions. Chapter 6 concludes.

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

"Starting about the mid 1990s AIDS-related illnesses account for about half of all hospital admissions in the country" (Uganda Ministry of Health, 2004)

2.1 Research Setting: Uganda

2.1.1 Demography

The Ugandan population consisted of 29.9 million people in 2006 (The World Bank Group, 2008) with the majority of the population (87.6 %) living in rural areas according to the 2002 Census (Uganda Bureau of Statistics, 2006). In 2005, the life expectancy at birth for men and women was 48 and 51 years respectively (WHO, 2007). The fertility rate of women in Uganda was 6.7 in 2006 (The World Bank Group, 2008).

The gross enrolment ratio in primary schools, which is defined as "the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown" by the United Nations Educational, Scientific and Cultural Organization (The World Bank, 2008a), has increased from 68.7% in 1990 to 116.7% in 2006 (The World Bank, 2008b). However, despite this gain, the gap between female and male literacy is still preponderant, though slowly closing. Table 1 shows some indicators of standard of living and communication technology use for urban and rural households. Table 1 reveals the stark disparity between the urban and

rural populations. Those living in urban areas have access to better conditions of living such as better housing.

Table 1 Standard of Living and Communication Technology Ownership Indicators by Location

Standard of Living and Communication Technology Use Indicators		
Indicators	Percentage of Urban Population Surveyed	Percentage of Rural Population Surveyed
Source of Livelihoods		
Subsistence Farming	11.9	77.0
Other Economic Activities	71.6	14.8
State of Dwelling		
Permanent Building Materials	59.8	10.6
Construction Materials		
Rammed Earth	28.8	85
Cement Screed	58.4	10.5
Household Facilities		
Covered Toilet	91.1	66.3
Built Bathroom	67.5	29.2
Communication Technology Use		
Television	19.7	2.1
Radio	68.5	46.1
Mobile Phone	21.8	2.3
Fixed Phone	2.7	0.2

Source: Adapted from Uganda Bureau of Statistics, 2006

Men in Uganda are advantaged in many aspects of life. The differences between genders are likely explained by the higher percentage of women (80%) that are confined to low return economic activities (subsistence farming) compared to men (63%) as revealed by the Ugandan Census of 2002 (Uganda Bureau of Statistics, 2006). The male dominance both socially and economically is reflected in the awareness level of anti-retroviral drugs (ARVs) whereby more men (70.4%) than women (44.8%) have knowledge of ARVS (Uganda Ministry of Health, 2004).

2.1.2 The Economy

Uganda was placed in the medium human development tier at the rank of 145 with a GDP per capita of $1,478 (USD PPP- Purchasing Power Parity) in 2004 in the Human Development Report of the United Nations Development Programme (UNDP, 2006). More than 35% of the population was living below the national poverty line for the most recent available year of data (UNDP, 2006). The per capita health expenditure is $75 (USD PPP) whereas Canada spent $ 2989 (USD PPP) in 2003 (UNDP, 2006).

Only 8% of the population have the luxury of electricity for lighting purposes and 82% of the population still used firewood for cooking purposes as of 2002 (Uganda Ministry of Finance, Planning and Economic Development, 2005). A recent survey in 2006 of a representative sample of the Ugandan population, shows that only 15% of those interviewed had access to piped water, primarily through a public tap (Uganda Bureau of Statistics and Macro International Inc, 2007)

Moreover, as of 2005, the unemployment rate was 23% (Uganda Ministry of Finance, Planning and Economic Development, 2005). Unemployment in Uganda can take many forms: under-employment, disguised unemployment, and structural unemployment (Uganda Ministry of Finance, Planning and Economic Development, 2005).

Agriculture remains the mainstay of the Ugandan economy. In 2005, it represented more than 90% of the country's export revenues (Uganda Ministry of Finance, Planning and Economic Development, 2005). The Census in 2002 (Uganda Bureau of Statistics, 2006) revealed that around 68% of the households derived their source of livelihood from subsistence farming.

2.2 The Health Sector

2.2.1 Structure and Characteristics of the Health Sector

The administrative structure of the Ugandan health system is shown in Table 2. The lower the health centers are in the hierarchy, the closer to the rural population they are and the less medical resources they have.

Table 2 Uganda Health System Structure

Administrative Level	Local Council Level	Health Organization	Staff Mix
Parish	II	Health Center II	1 enrolled nurse, 1 enrolled midwife and 2 nursing assistants
Sub County	III	Health Center III	1 clinical officer, one enrolled nurse, 2 enrolled midwives, 1 nursing assistant, 1 health assistant, 1 laboratory assistant and 1 record officer
County	IV	Health Center IV	1 ≤ medical officer, 2 clinical officers, 1 registered midwife, 1 enrolled nurse, 1 enrolled midwife, 1 comprehensive nurse, 2 nursing assistants, 1 laboratory technician, 1 laboratory assistant, one health inspector, one dispenser, one public health dental assistant, one Anesthetic Officer, one Assistant Health Educator, one Records Assistant, one Accounts Assistant and two support staff.

Source: Adapted from Uganda Ministry of Health et al., 2002 and Uganda Ministry of Health, 2007

Decentralization of HIV/AIDS related services is an official policy of Uganda. With HIV/AIDS being one of the main causes of mortality in Uganda, specific HIV/AIDS

health related services have been established at different levels of the health care structure. These services include VCT, Prevention of Mother to Child Transmission (PMTCT) and Anti-Retroviral Treatment (ART).

2.2.2 Health Facility Use in Uganda

The percentage of the population living within 5 kilometers of their preferred source of care and within 5 kilometers of a government health care facility is shown in Table 3.

Table 3 Percentage of the Population Living within 5 km of Different Types of Health Facilities

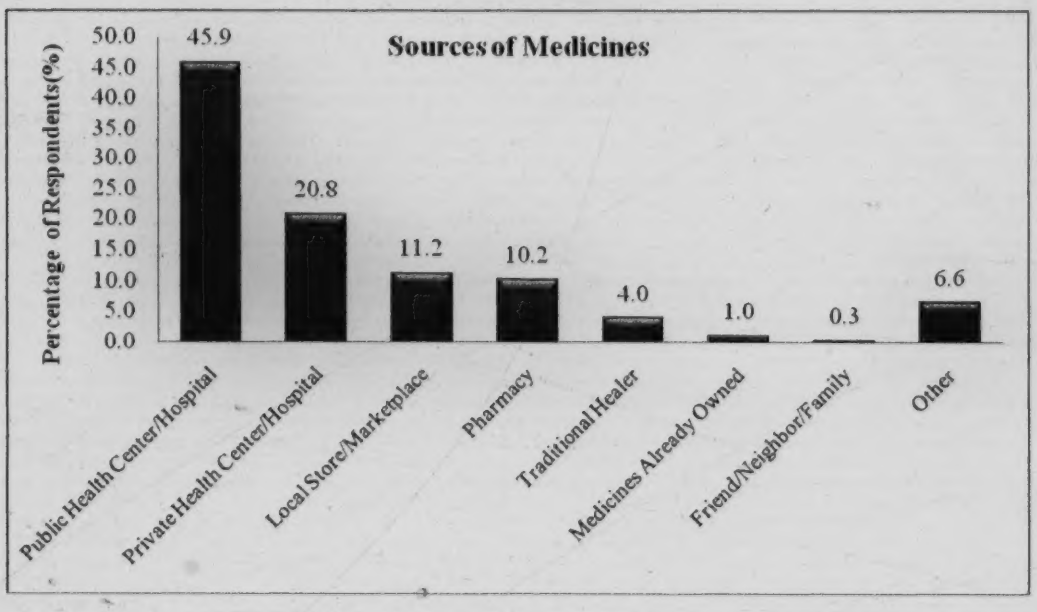
Region of Uganda	Population Living within 5 km to the Health Facility Where Care Is Sought First (%)	Population Living Within 5 km of a Government Health Facility (%)
Kampala	89.6	78.2
Central Without Kampala	80.8	70.3
Eastern	82.7	76.6
Western	78.1	71.5
Northern	78.9	76.3
Total	80.5	73.6

Source: Adapted from Uganda Bureau of Statistics, 2005

The largely rural Western region has the lowest percentage (78.1%) of the population living within 5 kilometers from their preferred source of care, whereas the urbanized Kampala area has more of its population living both within 5 kilometers of their preferred source of care and a government health care facility.

Figure 1 illustrates that more than 50% of the respondents in a survey (the respondents were from four geographical clusters in Uganda) sourced their medications from outside the government systems. This implies that patients' files at government health centers do not give a complete picture of drug consumption of patients.

Figure 1 Sources of Medicines



Source: Adapted from Uganda Ministry of Health et al., 2002

2.2.3 Challenges in the Ugandan Health Sector

The health system encounters a number of challenges including: lack of staff, poor drug supply system, and low financial resources. An important weakness of the Ugandan health system is problems in drug supply management. Table 4 shows the duration over which public health facilities experienced drug supply problems in a survey conducted in

2002 (Uganda Ministry of Health, 2002). Almost half (47%) of the health facilities surveyed experienced a stock-out period of one to three months.

Table 4 Stock-out Duration at Public Health Facilities

Stock-out Duration	Health Facilities Surveyed (%)
<1 month	7
1-3 months	47
3-6 months	27
>6 months	20

Source: Uganda Ministry of Health et al., 2002

Problems in drug supply have the potential to affect negatively health programs such as HAART where, interruption in treatment can lead to drug resistance. The public's knowledge of how to take their medications appropriately is also an issue. In a survey in 2002, it was found that 75% of the individuals at public health facilities did not understand how to take their medication properly (Uganda Ministry of Health *et al.*, 2002). The use of volunteers to help the patients to take their medication properly in the CB-DAART program therefore responds to this local health sector issue.

Medical staff in Uganda are difficult to come by, especially with the added burden of HIV/AIDS-related morbidity. In 2004, there was less than 1 physician for every 10,000 Ugandans in comparison to Canada where the physician density was 19 per 10,000 inhabitants in 2006 and the nurse and midwifery density per 10,000 Ugandans was 7.0 in 2004 versus 101.0 nursing and midwifery staff per 10,000 Canadians in 2006 (WHO,

2008 (a) and (b)). Within this context of medical staff scarcity, relying on community resources for health care is potentially important.

2.2.4 Community-Based Health Programs

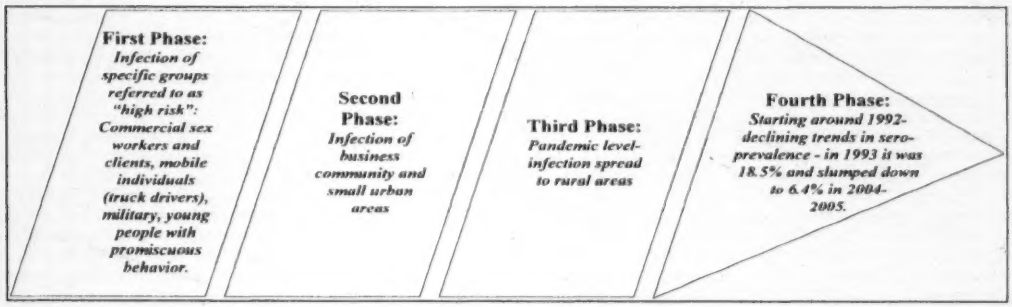
Uganda has a strong history of government support for community involvement in the health sector. There are several activities that are led by communities including HIV/AIDS prevention, malaria and immunization campaigns (Uganda Ministry of Health, 2004). Despite these activities, a report by the Uganda Ministry of Health (2004) indicated that motivating the community to volunteer was sometimes problematic. Communities also expect volunteers to be remunerated (Uganda Ministry of Health, 2004). Those two challenges can potentially jeopardize the sustainability of the volunteer programs in Uganda.

2.3 HIV/AIDS in Uganda

2.3.1 HIV/AIDS: From Epidemic to Pandemic

From the first reported case of AIDS in Uganda in 1982, the disease has reached a pandemic level in less than a decade (Uganda Ministry of Health, 2004). At the time of the first cases of AIDS, a proper response was not designed as the country was experiencing periods of civil wars (Uganda Ministry of Finance, Planning and Economic Development, 2005). Figure 2 below shows the evolution of the disease from epidemic to pandemic status.

Figure 2 Evolution of the HIV/AIDS Epidemy since 1982 in Uganda


First Phase:
Infection of specific groups referred to as "high risk": Commercial sex workers and clients, mobile individuals (truck drivers), military, young people with promiscuous behavior.
Second Phase:
Infection of business community and small urban areas
Third Phase:
Pandemic level-infection spread to rural areas
Fourth Phase:
Starting around 1992-declining trends in sero-prevalence - in 1993 it was 18.5% and slumped down to 6.4% in 2004-2005.

***Source: Adapted from Uganda Ministry of Health, 2004 and* Uganda Ministry of Health and ORC Macro, 2006**

Though the full impact of the HIV/AIDS pandemic is difficult to comprehend, a partial list of effects in Uganda as revealed by the Uganda AIDS Commission (2008) includes: a reduction in life expectancy; an increase of orphans- up to 2.18 million orphans by the end of 2005; exhaustion of household savings; main cause of poverty; increase of opportunistic infections and increase burden on the health sector with 50-70 % of all hospital admissions being HIV-related.

2.3.2 Uganda HIV/AIDS Epidemiology

A survey by the Uganda Ministry of Health and ORC Macro (2006) which included 18,625 for the age group 15-59 years old and 16,906 individuals for the age group 15-49 years old individuals, showed that the highest prevalence of HIV/AIDS was among females, the employed, the wealthiest and those living in urban areas. Table 5 shows that

Uganda seems to experience the feminization of HIV/AIDS as more women (7.5%) than men (5.0%) are infected (Uganda Ministry of Health and ORC Macro, 2006). The overall infection rate in 2004-2005 was approximately 6.4% for the age group 15-49 years (Uganda Ministry of Health and ORC Macro, 2006).

Table 5 Epidemiology of HIV/AIDS in Uganda

Demographic characteristics		Prevalence Rate (%)
Gender	Male	5.0
	Female	7.5
Education	No Education	6.2
	Primary Incomplete	6.3
	Primary Complete	8.2
	Secondary +	5.8
Employment	Employed	7.3
	Unemployed	4.7
Wealth quintile	Lowest	4.4
	Second	5.5
	Middle	6.0
	Fourth	6.5
	Highest	8.6
Residence	Urban	10.1
	Rural	5.7

Source: Adapted from Uganda Ministry of Health and ORC Macro, 2006

2.3.3 Ugandan Success in the Fight against HIV/AIDS

When the spread of HIV/AIDS first started, the Ugandan Government under the central direction of the President Museveni, launched a three-pronged prevention strategy commonly known as ABC- Abstinence, Be faithful and use of Condoms (Okware *et al.*, 2005). Over time, other anti-HIV/AIDS strategies have been incorporated such as VCT, PMTCT through the administration of one dose of Nevirapine during pregnancy, ART and HIV/AIDS care and support services. As a result of these and other efforts, Uganda is the only African country that has succeeded in registering a reversal in the growing trend of HIV/AIDS. The Ugandan openness, especially President Museveni's, on the matter of HIV/AIDS has been recognized as one of the main reasons of the decline of HIV/AIDS in Uganda (Pisani, 2002).

2.3.4 HIV/AIDS Services in Uganda

A survey across Uganda showed that there was 85 ART centers in December 2004, with more than one third (34) in the Kampala district (Uganda AIDS Commission, 2005). Table 6 shows the different types of services related to HIV/AIDS offered in the Kabarole district, where the fieldwork for this study took place.

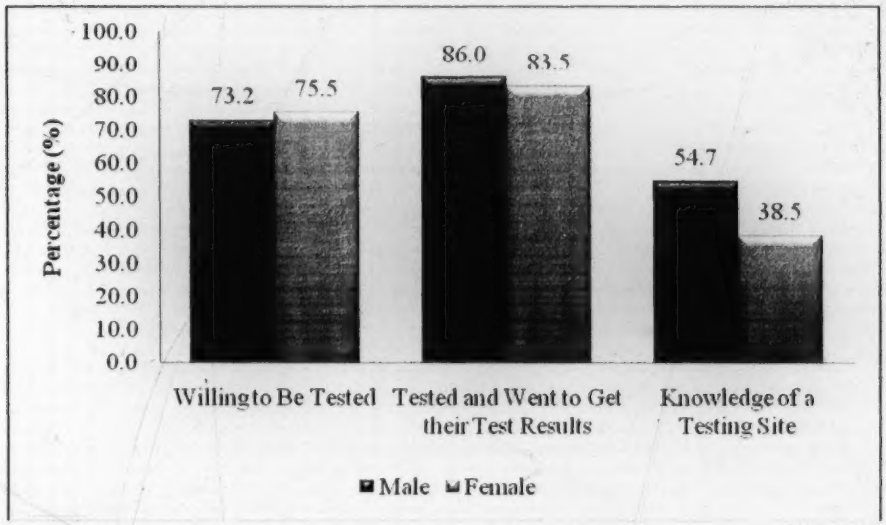
Table 6 Some AIDS-related Services in Kabarole

Service	Number
VCT Centers	5
Sexually Transmitted Infection Centers	1
PMTCT Centers	4
Psychosocial Services	10
ARV Treatment Centers	3

Source: Adapted from Uganda AIDS Commission, 2005

Males and females are known to access these services differentially. For example, the ten sites delivering psychosocial services in Kabarole (Table 6) are used almost twice as much by females than as males (Uganda AIDS Commission, 2005). Figure 3 shows the percentage of males and females and their respective behavior towards various factors in testing. The greatest difference between genders is shown to be regarding knowledge of testing services where males have more information.

Figure 3 Knowledge and Behavior Regarding HIV/AIDS Testing in Uganda: Results of a Survey



Source: Adapted from Uganda Ministry of Health, 2004

2.3.5 Knowledge of HIV/AIDS in Uganda

A general knowledge of HIV/AIDS can be important to prevention and treatment efforts. Table 7 shows the knowledge of HIV/AIDS of a sample of adult Ugandans.

Table 7 Knowledge of HIV/AIDS among Ugandan Adults

Knowledge Evaluation	Percentage of Males in Survey with Correct Answer	Percentage of Females in Survey with Correct Answer
Is there anything one can do to avoid contracting AIDS?	94.3%	87.3%
Reduce chances of getting AIDS by abstaining	90.9%	90.6%
Reduce chances of getting AIDS by having one partner	89.4%	88.0%
Reduce chances of getting AIDS by using a condom	74.6%	64.1%
Is it possible for a healthy looking person to have AIDS	76.9%	73.0%
Knowledge of HIV/AIDS virus being transmitted from mother to child	79.9%	85.9%

Source: Adapted from Uganda Ministry of Health, 2004

In general, the respondents of the survey have a good knowledge of HIV/AIDS, with men scoring higher than women do on all subjects evaluated except for mother to child transmission. Of concern is the result indicating that more than 20% of both men and women think that a healthy looking individual is not a carrier of HIV/AIDS.

2.3.6 HAART and its Implementation in Uganda

Highly Active Anti Retroviral Therapy (HAART) is a type of ART. HAART is not a cure for HIV/AIDS but a lifelong treatment, where adherence to the drug regimen is crucial. Lange (2006) explained that poor adherence might result in drug resistance jeopardizing the on-going treatment and the potency of future drugs combinations due to cross-resistance among ARVs. In turn, drug resistance sometimes requires that patients be switched to a more costly second line regimen, which increases drug expenses and reduces accessibility. It is widely agreed in the literature that an adherence level of 95% or greater is needed to effectively control viral replication (Wohl *et al.*, 2004).

With worldwide advocacy for cheaper drugs and the advent of generic drugs, the access to ARVs in developing countries has improved (Uganda Ministry of Finance, Planning and Economic Development, 2005). Table 8 shows the difference between the prices of ARVs in Africa compared to the United States.

Table 8 Cost of ARVS: Undiscounted and Discounted

Drugs	US Price (Undiscounted)	Africa Price (Discounted)
Lamivudine	$2,760	$219
Stavudine	$3,120	$55
Nevirapine	$2,976	$437
Efavirenz	$2,796	$500

Source: Adapted from Amoroso et al., 2006

Cheaper drugs have been widely credited as one of the reasons for increased accessibility of ART treatment in developing countries.

Service providers of ART in Uganda are regulated by the *National Guidelines for Implementation of Anti Retroviral Therapy* (Uganda Ministry of Health, 2003a). Requirements for accreditation include but are not limited to trained staff, VCT services, appropriate space for counseling to respect the patients' privacy, minimum laboratory services, good storage system for ARV drugs, reliable drug supply, and appropriate record keeping. The *National Anti Retroviral Treatment and Care Guidelines for Adults and Children* (Uganda Ministry of Health, 2003b) helps practitioners by providing clear directions on diagnosis, when to start ART, follow-up and monitoring of ART patients and stopping ART among other processes. The Guidelines recommended starting ART for patients at World Health Organization Stage 4, advanced World Health Organization Stage 3, or CD-4 less than 200/mm3 of plasma. Other criteria are also described.

Despite progress made in providing HAART in Uganda, there remain several challenges to implementing widespread access to ARVs. The ART coverage among people living with AIDS in the advanced stage was 27.0% for the year 2006 (WHO, 2008a). Reasons for low coverage include scarcity of staff, stigma associated with the disease, access to health facilities and services, insufficient VCT services, uncertainty regarding dosages for children, a shortage of laboratory tests, and costs of ARVs, which are still unaffordable for most Ugandans (Uganda Ministry of Finance, Planning and Economic Development, 2005).

2.4 Economic Evaluation in Health Care

2.4.1 Types of Economic Evaluation

The Canadian Agency for Drugs and Technologies in Health (CADTH) (2006) describes five types of economic evaluation in health care in the *Guidelines for the Economic Evaluation of Health Technologies*: Canada: Cost Utility analysis (CUA), Cost Effectiveness Analysis (CEA), Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA) and Cost Consequences Analysis (CCA). The next section will describe Cost Consequences Analysis (CCA) and describe why it is the type of analysis chosen for our study.

2.4.2 Cost Consequences Analysis

Drummond *et al.* (2005) described Cost consequences Analysis as an economic analysis whereby disaggregate data on outcomes and costs are presented without an incremental ratio being explicitly produced. In this type of study, Drummond *et al.* (2005) contended that the policy maker make their own analysis and reach their own conclusion based on the disaggregated data presented. There are several reasons why a CCA is used (CADTH, 2006):

- When there is "No unambiguous evidence to conclude that there is a "meaningful difference" in important patient outcomes";
- When the programs have several benefits and using a CCA makes it easier to appraise;

- To increase the transparency of other types of economic analyses.

In our study, results indicate that the primary outcomes of the two treatment models are not significantly different. Moreover, our community-based model of delivery of HAART in Rwimi has several benefits other than the primary outcome of the study, which is a viral load of less than 400 copies/ml of blood. The benefits include, but are not limited to, increased life expectancy, increased accessibility of HAART to rural areas and increased societal equity. Finally, we wish to have a transparent means of informing policy makers. Therefore, a CCA is a good fit for our purposes.

Authors such as Mauskopf *et al.* (1998) present several arguments in favor of CCA studies.

> The cost consequence format is more likely to be approachable, readily understandable and applied by healthcare decision-makers (...) In general, the cost consequence approach, by making the impact of the new treatment as comprehensive and transparent as possible, will enable decision-makers to select the components most relevant to their perspective and will also give them confidence that the data are credible to use as the basis for resource allocation decisions.

2.4.3 Designs of Economic Studies

Several study designs can be used in order to gauge the costs and effectiveness of an intervention: cross sectional studies, retrospective studies, prospective studies, randomized controlled trials (most used), meta analysis and finally primary cost

effectiveness studies (Muennig, 2002). Each of them has both strengths and shortfalls (Muennig, 2002).

Primary cost effectiveness analysis, the approach taken in this study, is the least used of all the methods mentioned above. Muenning (2002) indicated that this design is used in "rare instances". It involves assigning to a group of individuals a health intervention and letting the treatment unfold as in the real world (Muennig, 2002). If there are any side effects from the intervention and, if these result in additional costs and visits, they are also recorded (Muennig, 2002). Moreover, costs are obtained directly as they unfold. There is however, some controversy over observational study designs and the use of statistical testing on results obtained from these studies. Therefore, our study is also subject to any criticisms, controversies and strengths that are usually associated with the observational design ((Ludwig (2005), Concato *et al.* (2000), Benson and Hartz (2000) and Pocock and Elbourne (2000)).

2.4.4 Important Concepts in Cost Consequences Analysis: Costs, Outcomes and Limitations

Direct and Indirect Costs

Costs in health care can be classified as direct or indirect (Luce *et al.*, 1996). The direct costs are all costs that can be allocated directly to the intervention. Indirect costs in economic analysis mean losses or gains in productivity that are caused by illness or death (Luce *et al.*, 1996). Examples of direct health costs in health care are doctor's time, nurse's time, capital, equipment, transportation, and out-of-pocket expenses. Direct non-

medical costs can take the form of child care, home care services and time of volunteers and family (Heshmat, 2001). According to Heshmat (2001), the ideal measure of the opportunity cost of time is the dollar value for the compensation for time spent on treatment but generally market prices are good estimates.

Fixed and variable costs

Fixed costs are incurred irrespective of whether or not the treatment is provided. They are buildings and durable medical equipment that do not enter into incremental cost analysis of an intervention (Heshmat, 2001). However, if an intervention causes clear changes in fixed resource use because it changes the number of patients, this should be included in the study (Muennig, 2002). All labor inputs should be included in the incremental cost analysis unless there are inefficiencies in terms of slack time that can be exploited (Heshmat, 2001). Variable costs are described as costs that vary with the number of units of health products produced.

Outcomes

There are different types of health outcomes that can be used in health economic evaluation. The preferred outcomes are final ones that are described as outcomes that express longevity and quality of life such as life years gained and quality-adjusted life years (CADTH, 2006). For HIV/AIDS treatment, several studies used life years gained and other health-related quality of life measurements as the final outcomes in economic evaluations of HAART. However, those studies were evaluating the outcomes on a long-term basis and information was available for at least the first year of treatment. Other

measures of the success of HAART have been used to evaluate on-going progress of HAART (Uganda Ministry of Health, 2003b):

- Clinical
- Immunological and,
- Virological (virologic suppression)

Of particular interest to us is the success of treatment as measured by virologic suppression at 6 months. The outcomes available for our study are mortality rates and virological data as measured by the 6-month viral load counts. The mortality rate would have been the preferred outcome as it is a final outcome. However, since all deaths will not occur in the lapse of 6 months in the project, it is not entirely appropriate to use this as a measure of the success of the treatment at 6 months. At this point in time, if the mortality rate happens to be low, it may not inform us on the state of the live patients and on whether the treatment is being successful for them. Therefore, the virological success rate of undetectable viral load (less than 400 virus copies per ml of plasma) at 6 months is more appropriate for our purposes.

Amoroso *et al.* (2006) explained that usually a viral load of less than 400 copies per ml of plasma is achieved at 12 weeks of treatment. Chaisson *et al.* (2000) found that for a group of patients on HAART followed up for at least 6 months, 63.5% of patients had a viral load of less than 400 copies per ml of plasma.

Limitations of economic studies of anti-HIV/AIDS Strategies

Harling and Soderstrom (2006) point out several potential limitations regarding CEA that also apply to CCA. The limitations include the use of data from past studies with methodological flaws to fill gaps in data needs in economic analyses, the use of non-representative settings, data gaps that are addressed by assumptions, and the exclusion of certain costs and benefits (Harling and Soderstrom, 2006).

2.4.5 Economic Studies of HAART

Numerous studies have investigated the costs and effectiveness of HIV/AIDS treatment. Table 9 below depicts the cost effectiveness of first line and second line regimen as measured by U.S. dollars per loss of disability-adjusted life years averted. As it can be seen, such ratios are very reductionist and do not provide comprehensive information that could better inform the decision-maker.

Table 9 Cost Effectiveness Ratios of Selected Studies

[illegible]	[illegible]	[illegible]
Marseille *et al.* (2002)	350-2000	
Creese *et al.* (2002)	1100-1800	
Masaki *et al.* (2003)	1317-2029	
Hogan *et al.* (2006)	556	1977

Source: Adapted from Canning, 2006

Table 10 shows HIV/AIDS studies in Africa that have different designs, analyses, and methodological approaches. It also shows how the studies handle variable and fixed costs evaluation and outcomes determination. One important aspect shown in Table 10 is the treatment of fixed costs, variable costs, the sources of data and the type of sensitivity analysis performed.

Table 10 Economic Studies of HIV/AIDS Treatment in Africa

	Studies		
	Badri *et al.* (2006)	**Cleary *et al.* (2006)**	**Uganda Aids Commission (2003)**
Location	Cape Town, South Africa	Khayelitsha, South Africa	Uganda
Aim	Assessing the Cost Effectiveness of HAART	Estimating the cost per Life year and quality adjusted life year gained	To Estimate the cost of providing HAART in Uganda
Type of Analysis	Cost Effectiveness Analysis	Cost Effectiveness Analysis with Markov Modelling	Cost analysis
Study Design	Prospective Cohort study- Compared two groups ART and no-HAART- Made sure they matched	Before and After study design	N/A
Sample Size	292 in HAART group and 1328 in no-HAART group	1729 patients	N/A
Perspective	Program Costs	Program Costs	Program Costs

Table 10 Economic Studies of HIV/AIDS Treatment in Africa (Continued)

	Studies		
	Badri *et al.* (2006)	**Cleary *et al.* (2006)**	**Uganda Aids Commission (2003)**
Types of Costs Included: Variable Costs	Inpatient day and outpatient visits	Medicine costs/Laboratory costs/	Cost of ARVs
	HAART drugs cost	Visits/Imaging and procedure costs	Tests and adding 2% for training
	All other non-HAART drugs prescribed and tests	Overhead costs	10% on drug and tests to account for storage, wastage and distribution costs
Types of Costs Included: Fixed Costs	None	Capital costs	None
Types of Cost Excluded: Indirect Costs, and Overheads	None	Overheads	Staff Costs

Table 10 Economic Studies of HIV/AIDS Treatment in Africa (Continued)

	Studies		
	Badri *et al.* (2006)	**Cleary *et al.* (2006)**	**Uganda Aids Commission (2003)**
Source of Data	HAART price from public sector price/inpatient costs and outpatient visits cost from a 2000 study	Government tenders/Market values/Patient's files/Surveys/Secondary source	JCRC, MildMay, MSF, and Medical Access
Source of Effectiveness Data	From study	From study	N/A
Types of Outcomes	Life Years Gained	Life Years Gained and Quality-adjusted Life Years	N/A
Sensitivity Analysis	Effects/Costs of service provisions	On Outcomes/Multi-way sensitivity Analysis	Test effect of minimal testing and extensive testing on cost of Benchmark case
Main Findings	Found that HAART is very favourable ranging from cost saving to $1,759	Cost Effective (with respect do a do-nothing alternative) - but declared that only policy-makers can decide of the cost effectiveness of a study	Benchmark case with moderate testing cost $483.18, with minimal testing $440.98, with extensive testing $617.54

Note: The currency is the US dollars and it has not been adjusted to a common base year

Studies by Badri *et al.*. (2006) and Cleary *et al.* (2006) showed favorable results for HAART. The last study shows the cost of HAART provision in Uganda under different scenarios. The study showed that the main cost was the cost of drugs.

An important observation is that the type of analysis performed fits the objectives of the study. On the one hand, Badri *et al.* (2006) as well as Cleary *et al.* (2006) wanted to assess the cost effectiveness of HAART. Therefore, they used a cost effectiveness analysis to achieve their objectives. On the other hand, the Ugandan AIDS Commission (2003) wanted to determine the cost per patient to deliver a scaled-up HAART program. Therefore, it used a cost analysis in order to address budgetary concerns. Our primary objective is to investigate the costs and outcomes associated with the CB-DAART at Rwimi and therefore a CCA format is appropriate.

CHAPTER 3

METHODS

"The resulting scarcity of resources requires the state to organize a cost effective method to maximize benefits to its population for the available funds." (Uganda Ministry of Health, 2004)

3.1 The Study

The intervention under evaluation (CB-DAART at Rwimi), funded by the Canadian Institute for Health Research (CIHR), is a project that originated from the Public Health Science Department at the University of Alberta, with the principal investigator Dr. Walter Kipp. The project is a multidisciplinary research, which involves medical, economic and social evaluations. The audience of the study is the policy-makers in Uganda.

The samples used in this thesis are derived from the larger-scale study of the CB-DAART model in Rwimi and the JCRC standard program in Fort Portal. The larger-scale study involves 385 patients distributed between the two cohorts. The 200 patients for the JCRC cohort were recruited over several months and originated from different parishes (A.Alibhai, Personal Communication, May 4, 2008). For the CB-DAART in Rwimi, the 185 patients originated from the Rwimi and Kibiito parishes, also over several months (A.Alibhai, Personal Communication, May 4, 2008).

Baseline data were collected as each patient first entered the program. However, patients were recruited over time, so they did not all start simultaneously. Our data covers the first 6 months of patients' participation, after a 6-month medical evaluation of the patient had been conducted. For this study, data were analyzed only on those patients who had been in the program for at least 6 months as of April 30th 2007. However, in the JCRC cohort, due to logistical constraints, it was not possible to collect data for all patients that reached 6 months at April 30th 2007. Therefore, a random sample of the 200 patients who met this criterion was generated by randomizing the identification numbers of the patients' files in a spreadsheet, and working down the list in the random sample obtained as far as available resources would allow. The result was a sub-sample of 61 patients from the JCRC program.

Though cost information was collected only over the 6-month period, effectiveness data were not always collected at exactly 6 months. Some of these data were collected as late as one or two months later because of delays in the 6-month follow-up appointment for some patients.

3.2 Design

The present study has a primary design through which costs and effectiveness data will be obtained. The study is a non-randomized experiment (Kipp *et al.*, 2004) with no control group- a design that is the result of logistical and circumstantial realities:

> Randomized allocation of subjects to the intervention and the established care group is not possible because rural patients are not likely to present to the urban treatment centers and vice versa. A non-randomized study design may introduce a possible selection bias. However, the classic randomized or case-control design is not viable in this "real world" situation. (Kipp *et al.*, 2004, pg 7)

> It is also not feasible to match participants in the comparison group to the participants in the intervention group due to logistical reasons in Uganda. However, demographic and socio-economic characteristics will be collected in both groups and differences between the two groups will be considered in the analysis. (Kipp *et al.*, 2004, pg8)

Despite the fact that this study is not a randomized study, this does not prevent the present analysis from gathering knowledge about a new HAART delivery model that showcases innovative skill and resource mixes as expressed by the extract below. The present study will thus relate to and build upon the following main idea:

> We believe that the limitations of this non-randomized study are outweighed by the potential gains in knowledge, as we will be able to assess whether community-based HAART is viable among the poorest and most underserved segments of the African population, and whether this population can achieve ARV success rates comparable to the more privileged and affluent urban

population, represented by the urban, hospital-based comparison group. (Kipp *et al.*, 2004, pg 7)

3.3 Perspective of the Study

The Panel on Cost Effectiveness in Health and Medicine in the United States recommended using a societal perspective so that relevant costs are included (Russell *et al.*, 1996). Societal perspective here takes the same meaning as defined by CADTH (2006) which means that direct costs to the public health sector, direct costs to the patients and productivity costs are considered. In this study, particular attention is given to the opportunity cost of time of patients (in both cohorts) and volunteers and treatment partners in the Rwimi cohort.

3.4 Target Population

The criteria for inclusion in the sample in the two cohorts are explained in Table 11. The criteria respect the requirements of the *National Guidelines for ART Treatment in Uganda* (Uganda Ministry of Health, 2003b) except with respect to the age requirement.

Table 11 Criteria for Inclusion in the Two Cohorts

1.	18 years and older
2.	Eligible for ARV treatment according to the national HAART guidelines: WHO Stage IV or advanced Stage III disease (or CD4 cell counts < 200 and a positive HIV serology)
3.	Eligible for free ARV treatment as defined by the *National Antiretroviral Treatment and Care Guidelines for Adults and Children*
4.	For urban region, recruited in hospital at Fort Portal and home-based care and Rwimi and Kibiito parishes for the rural region
5.	Suitable spouse/partner/adult household member or friend willing to support HAART as treatment associate in the Rwimi cohort
6.	Stable residence in an area with an established, participating volunteer
7.	Not receiving a rifampicin-containing regimen for Tuberculosis treatment (subjects will be eligible two weeks after completing rifampicin-containing component of Tuberculosis therapy)
8.	No previous ART therapy
9.	Absence of uncontrolled alcohol abuse

Source: Adapted from Kipp et al., 2004

3.5 Type of Analysis

The analysis is a special type of CEA: CCA. There are different reasons why a CCA is appropriate for our purpose, as was explained in section 2.4.2.

3.6 The Intervention: The CB-DAART at Rwimi

The intervention is situated in the district of Kabarole in western rural Uganda in the parish of Rwimi in a Health Center III. The district is home to 386,488 inhabitants (District Information Portal, 2007a) with agriculture as the main economic activity, even though most of it is in the form of subsistence farming (District Information Portal, 2007b). The HIV prevalence rate is 11.6% and the doctor to patient ratio is 1:19178 while the patient to nurse ratio is 1:2609 (District Information Portal, 2007c). There are 47 health units serving the districts with 75% of the population living within five kilometers of a health facility (District Information Portal, 2007c).

The CB-DAART program at Rwimi is an intensive HAART program where a community volunteer performs a weekly assessment of the patients and a treatment associate volunteer to monitor everyday adherence to the pills. The CB-DAART program starts by recruiting participants through different ways, for example through VCT programs, through PMTCT programs and referral systems from other health centers in the parishes of Rwimi and Kibiito. The patient, after a confirming HIV test, undergoes a CD-4 test, which determines the number of CD-4 cells per ml of plasma. A baseline viral load is also performed. If the CD-4 cell count is less than 200 cells per ml or if the patient is diagnosed of being at WHO Stage 3 or 4, the patient is offered to either enroll in the study project or simply to enter into a different HAART program. If the patient agrees to participate in the study, the patient comes back with a treatment partner and can start the fourteen days lead-in dose of the ARV drugs, which consists of Stadivudine, Lamivudine and Nevirapine. Nevirapine is taken only once a day to assess the tolerance

of the patient to it during the first 14 days. After 14 days, the patient goes for a doctor visit to initiate the full dose. If the patient tolerates the Nevirapine well, the patient is initiated on the full dose of the ARV regimen started in the first 14 days. Table 12 shows the dosage of the lead-in and full dose ARV regimens. The regimens shown in Table 12 are triommune. If the regimen contains 30g of Stadivudine it is known as T-30 (Triommune 30) or if it includes 40 g of Stadivudine it is called T-40 (Triommune 40). If the patient does not tolerate the Nevirapine, the regimen is replaced by a regimen with no Nevirapine such as Stadivudine, Lamivudine and Efavirenz.

Table 12 ARVs Drug Regimens

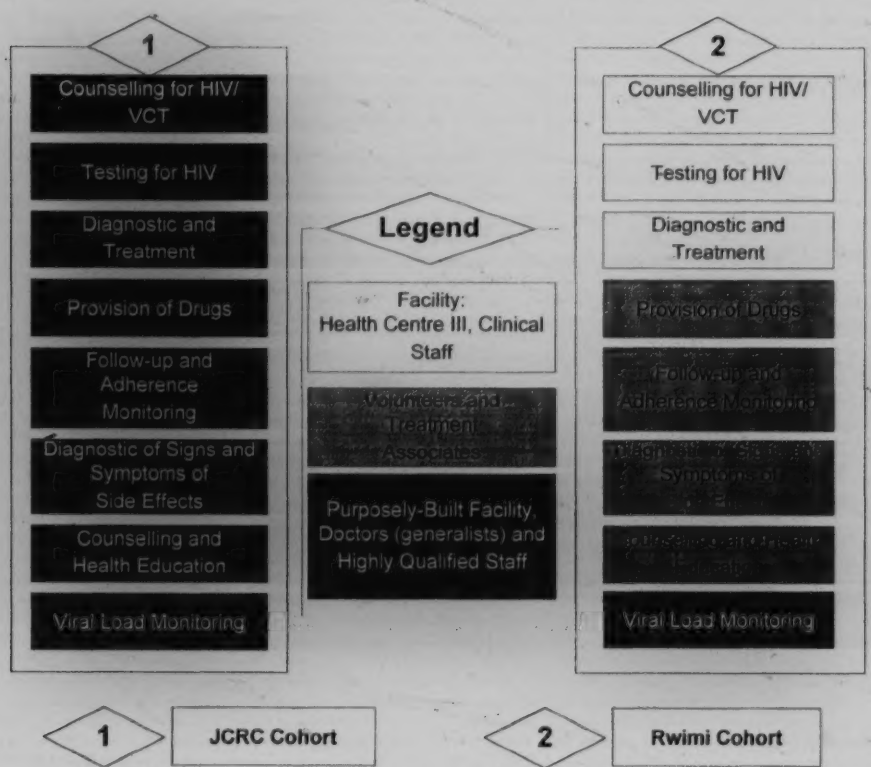
Drugs	Lead-in Dose	Full Dose
Stadivudine (30 mg or 40 mg)	Twice a day	Twice a day
Lamivudine (150 mg)	Twice a day	Twice a day
Nevirapine (200 mg)	Once a day	Twice a day

If the patient suffers from tuberculosis during the treatment, the patient has to change HAART regimen, as the anti-tuberculosis regimen containing rifampicin is incompatible with Nevirapine. The T-30 and T-40 regimen is usually replaced by Zidovudine, Lamivudine, and Efavirenz (A. Clare, Personal Communication, August 4, 2006).

The next scheduled doctor visit after the patient has been initiated on the full dose is in 6 months, unless the patient experiences the need to see the doctor before that date due to side effects or opportunistic infections. During those 6 months, a treatment partner ensures that the patient takes his/her ARV drugs by observing the actual intake. The

volunteers are trained to count the ARV pills weekly to monitor adherence, to advise and provide health education, and to monitor side effects and opportunistic infections. This is an intensive program whereby the patients are monitored daily as opposed to a standard program where the patient is monitored monthly by doctors or clinical officers, as is the case in the JCRC program. Figure 4 below shows the difference in the use of resources in the two HAART delivery models.

Figure 4 The Two Treatment Programs and Their Differential Resources Use



The visits by the patients have been classified as scheduled and unscheduled visits. The scheduled visits are the visits that are programmed in relation to the treatment delivery. Appendix A shows that the number of scheduled visits starting from the pre-visits through the 6-month evaluation is 6. However, for our economic assessment the author included scheduled visits from the lead-in dose visit (Visit 2B) to Visit 4. On the other hand, the unscheduled visits are the visits that the patients have in relation to opportunistic infections treatments, side effects management and possibly other illnesses not directly related to the HIV/AIDS conditions.

One feature of the CB-DAART program calls for a clarification: The presence of doctors at the Rwimi Health Center III. In Chapter 2, it was explained that Health Centers III in Uganda are not staffed by doctors. In the CB-DAART project, the doctors have the purpose of trainers. They are hired to oversee the HAART program at the Health Center III and to train the clinical staff in HAART program management. After this training period, the staff at Rwimi Health Center III is solely responsible for the HAART program. After the training period, the doctors are present at the health facility only on two days – in this case, Wednesdays and Fridays, when the HAART clinic takes place- for ethics reason related to the research. The doctors' time therefore represents a short-term training cost that has been accounted for. Another way of looking at the doctor's time costs is as an investment in accelerating the learning curve of the clinical staff.

3.7 The Comparison Treatment: JCRC Cohort

The comparator is a HAART program at the JCRC AIDS Clinic in Fort Portal, the capital town of the Kabarole district. The JCRC clinic belongs to a network of 42 clinics whose headquarter is located in Kampala and is one of its five regional centers of excellence (JCRC, 2008). Born from an initiative in 1991 of the Makerere University School of Medicine in collaboration with Uganda's Ministries of Health and Defense, the JCRC was initially dedicated to be an AIDS research center (JCRC, 2008). The first to introduce ARV drugs in Uganda in 1996, the program expanded with the help of USAID in 2003 to provide ARVs to Ugandans through a program called TREAT (Timetable for Regional Scale up of ARV Therapy) (United States Embassy in Kampala, 2008). The JCRC in Fort Portal forms part of this initiative and was opened in 2004. The facility is a modern state of the art purposely-built clinic with sophisticated laboratory services with viral load, CD-4 and a wide array of tests being offered. The clinic is found in the compound of the Buhinga hospital, the district hospital of Kabarole, and share human resources such as doctors with the hospital.

As explained before, the intervention and the comparator have different intensities of follow-up whereby the JCRC is a standard HAART program with patient's monthly visit, usually for procurement of ARV pills and adherence follow-up as opposed to daily follow-up for adherence in the CB-DAART in Rwimi. The patients are recruited in different ways, which include VCT, PMTCT, recruiting from the community, from the in-patient ward of the Buhinga Hospital and by referral from other health centers. If the

patient presents to the clinic with claims of previous positive testing, proof is requested. In cases where the patient has not been tested the patient goes through the process of VCT. Positive patients are attributed identification numbers depending on the type of HAART program they qualify for at the clinic. The patient qualifies for the donor-funded TREAT program if he/she falls under one of the following categories:

- Orphans and vulnerable groups
- Orphans' care takers
- Poor women (widows)
- Spouse of poor women
- Pregnant women
- Health workers

In the case, the patient does not qualify for the TREAT program, then the patient is enrolled on the Uganda Ministry of Health program. Another marked difference between the TREAT and Uganda Ministry of Health patients is that the Uganda Ministry of Health patients receive branded drugs whereas the TREAT patients received generic drugs. All positive patients undergo a CD-4 and a baseline viral load test. The CD-4 test is used in the determination of whether the patient meets the criteria for HAART program enrolment. Indeed, if the patient's CD-4 cells count is less than 200 then the patient is initiated on a HAART program. The patient is also enrolled if diagnosed as being in WHO Stage III or IV of the disease. Otherwise, the patient is followed up on a regular basis, until he/she is deemed at a stage of the disease that HAART can be started. CD-4 and viral load tests performed at several points during the treatment give an

indication of treatment performance. It must be noted that TREAT patients receive free CD-4 and viral load tests while the Uganda Ministry of Health patients must pay.

After it has been determined that the patient meets the criteria to enroll in a HAART program, the patient is started on the lead-in dose as shown in Table 12. Following the lead-in dose, the patients return to the clinic after 14 days for the full dose initiation visit, after which the patients are encouraged to come every month for refill of the ARV drugs, adherence monitoring and counseling.

3.8 Socio-Demographic Analysis

The Scientific Proposal (Kipp *et al.*, 2004) explained that because of logistical reasons no matching was possible for this non-randomized study. Data on each group were collected from patients' files. For the JCRC cohort there was an additional source of information, which is the Socio-economic Survey (SES). This analysis enables us to assess the generalizability of the results from each group and to assess whether the JCRC cohort includes patients with similar socio-demographic characteristics as the Rwimi cohort. The analysis contributes in determining the external validity of the study and whether the patients' in the JCRC cohort are comparable to the patients' at Rwimi Health Center.

3.9 Outcomes

Measures of primary outcome are derived from the number of successful cases, described as a patient with a viral load of less than 400 copies per ml of serum. The test for the viral load was done at 6 months. Other secondary outcomes, such as mortality rates,

decreased visits to the health center and increased geographical accessibility will also be assessed.

3.10 Identifying, Quantifying and Evaluating Direct and Indirect Costs

3.10.1 Drugs: ARV and Non-ARV Drugs

Quantity

For both treatment cohorts the quantity of drugs consumed was derived from the patients' files. The types of drugs consumed were noted from the patients' files and the standard prescription for the drugs was obtained from a clinical officer at JCRC for the non-ARV drugs and a clinical officer from Rwimi for the ARV drugs. Table 13 shows an example of how the drugs were quantified for a patient who did not change regimens and for a patient who changed regimens from the Rwimi Cohort. All the Triommune regimens were assumed to be T-30 regimens. The same procedure applies for the JCRC cohort.

Table 13 Quantification of ARV Drugs

No Change in Regimen – T-30 Case			
	Number of Days	**Prescription**	**Total Quantity**
Lead in Dose (T-30)	14	As in Table 12	14 doses
Full Dose (T-30)	169	As in Table 12	338 doses
Change in Regimen – T-30 Case			
	Number of Days	**Prescription**	**Total Quantity**
Lead in Dose (T-30)	14	As in Table 12	14 doses
Full Dose (T-30)	43	As in Table 12	86 doses
Change in Regimen (Combivir)	98	Twice a day	196 doses
Change in Regimen (T-30)	28	As in Table 12	56 doses

Appendix B shows the calculations for the costs of the different ARV regimens used for the Rwimi and JCRC cohorts. Appendix C shows different ARV regimen calculations conducted for all patients in both cohorts including those who changed and did not change regimens.

Table 14 shows the quantification of non-ARV drugs for a patient at Rwimi.

Table 14 Examples of Quantification of Non-ARV Drugs

Quantification of Non-ARV Drugs for a Rwimi Patient			
	Number of Days	**Prescription**	**Total Quantity**
Cotrimoxazole	183	2 tablets a day	366
Multivitamin	30	2 tablets twice a day	120
Multivitamin	30	2 tablets twice a day	120

Appendix D details how the unit value was calculated for each non-ARV drugs that was prescribed in each cohort and for which a price was available on our price list. Where the drug names were not legible in the handwritten patient records, or could not be identified for other reasons, the mean of drug costs in each cohort was used (excluding the cost of an anti-tuberculosis prescription as for those patients with missing cases they were either on Nevirapine prescriptions or it was clearly indicated that they were not on any tuberculosis drugs in the column in the patient file dedicated to that purpose). Also prices for several drugs (for example Loridine, cold cap, benzathine, omeprazole and Workeine) could not be identified. Therefore, they were not included in the costing exercise for either cohort. There were 5 such cases in Rwimi and 6 in JCRC. Appendix E shows how the dose for the tuberculosis treatment was calculated for the eight-month tuberculosis treatment. Appendix F shows the types of non-ARVs drugs prescribed, the standard prescriptions and the total value consumed for non-ARVs drugs per patient. The data for

each patient was extracted from each of the patient's records and entered in a spreadsheet by the author and double-checked by research assistants.

Prices of Drugs

The prices for the ARV drugs were obtained from the *Quality Chemicals Limited's Cipla's Range of Human Drugs Price List* (Quality Chemicals Limited, 2007). The prices for non-ARV drugs were obtained from the *National Medical Stores (NMS) Catalogue and Price Indicator* (NMS, 2007) and the *Joint Medical Store (JMS) Catalogue and Price Indicator* (JMS, 2007). As the primary purpose of quantifying these costs is for comparison, deflating is not necessary. The study period is relatively short, and regardless, both groups would be impacted the same way if the inflation rate was taken into explicit consideration.

Total Costs

The total costs were obtained in the following way. First, the types of drugs consumed by each patient were extracted from the patient's file. Then the standard prescription was obtained for each type of drugs to calculate the quantity consumed. For example, Diclofenac, also known as Voltaren, has a standard prescription of 2 tablets 3 times a day for 3 days. This gives a total of 18 pills consumed over the course of the three days. Once the total drugs were obtained, the pre-calculated unit costs of the drugs were multiplied to the quantity of the drugs prescribed. Again for the example of Diclofenac, the calculated cost of 1 tablet is 9.09 USh (all the prices quoted in this thesis is in 2007

USh). Multiplying this number by 18 yields a total costs for the prescription at 163 USh. This exercise was repeated for each patient's prescriptions.

Assumptions Related to Drugs Quantification and Valuation

It was assumed that all patients were prescribed Cotrimoxazole also known as Septrin. All drugs prescribed during the 6-month period of our analysis for both cohorts were included, whether they would be fully consumed during that period or not. The prices of the generic drugs were used for both regimens. All the non-ARV drugs prescribed in the patient's files were assumed to be related to HIV/AIDS even if some of the drugs could not be identified. Where there were several prices quoted for the same drugs, the price with the most favorable bulk discount was used in both cohorts.

3.10.2 Doctor's Time and Other Medical Staff Time

Quantity

The time dedicated by the medical staff at the JCRC AIDS clinic to the 46 patients in our study, was apportioned to these patients out of the total medical time available from the staff for all the patients that form part of the JCRC clientele. Therefore, the total number of visits for the patients in our sample as a proportion of the total number of visits at the clinic in 6 months was used to calculate the cost for the 46 patients in our study. A doctor at the JCRC clinic is remunerated at 2.5 million USh per month (Personal Communication, A.Alibhai, December 17, 2007) and over the course of 6

months this amounts to 15 million USh. Therefore, on apportioning the cost for doctor's time per patient was obtained as shown in Table 15.

Table 15 Valuation of Doctor's Cost at JCRC

Total Number of Visits at the Clinic for 6 Months	
Number of Working Days per Month	21
Average Number of Visits per Day*	83.3
Total Number of Visits for 6 Months	10,496
Visits of the 46 Patients in the Study as a Percentage of Total Visits at JCRC (250 visits)	2.38%
Cost of for Doctors for 6 Months	
Salary for 6 Months(USh)	30,000,000
Total Number of Visits at the Clinic for 6 Months for the 46 Patients	
Cost for the 46 Patients (USh)	2.38% x 30,000,000= 715,000
Cost per Patient (USh)	715,000 / 46 = 16,000

Source: Personal Communication, A.Gwaita, May 13, 2008. It was assumed that there were 70 visits per month in the first 8 months and 110 visits for the last 4 months of 2007.

The valuation of cost for the clinical staff at JCRC is shown in Tables 16 and17.

Table 16 Valuation of Clinical Staff Time at JCRC

Job Description	Equivalent at Rwimi Health Center	Number	Monthly Salary at Rwimi Health Center** (USh)
Enrolled nurse/counselor- MOH- seconded for duty	Enrolled Nurse	1	300,000
Enrolled nurse/counselor- MOH- seconded for duty	Enrolled Nurse	1	300,000
Cashier- Volunteer	Support Staff	1	20,000
Sorting of files and registration- Volunteer	Support Staff	1	20,000
Clinical Officer*	Clinical Officers	3	3 x 420000
Senior Nursing Officer	Registered Nurse	1	400,000
	Total Cost of Staff Per Month	8	2,300,000

Source: Personal Communication, E.Tabusibwa, July 4, 2006

****The information pertaining to two additional clinical officers came from the patients' files and was confirmed by personal communication (A.Gwaita, June 08, 2008)***

***** Source: (Personal Communication, Rwimi CB-DAART Project Staff, October 8, 2007)***

Table 16 shows the mechanism for obtaining an economic value of the clinical staff at JCRC. First, a concordance exercise was performed to determine to what position in the public sector each relevant position at JCRC corresponded. This exercise was necessary because there were no cost data available for the clinical staff at JCRC. The second column in Table 16 above shows the assumptions made about the corresponding clinical staff level in the public sector for each staff type at JCRC. For example, the position of senior nursing officer at JCRC was assumed to be the equivalent of a registered nurse at the Rwimi Health Center. This is probably a conservative estimate of the cost of the senior nursing officer at JCRC.

Table 17 shows how the costs per patient was calculated. For the six months, it was determined that the number of visits for the 46 patients in our study represents 2.38% of the total number of visits at the JCRC clinic. The costs for the 46 patients were calculated by multiplying this percentage to total clinical costs, which was then divided by 46 to obtain a cost per patient.

Table 17 Valuation of Clinical Staff Time at JCRC

Visits at the Clinic for 6 Months	
Percentage of Total Visits Attributed to the 46 Patients (%)	2.38
Salary for the Clinical Staff for 6 Months	
Salary per Month (USh)	2,300,000
Salary for 6 Months (USh)	13,800,000
Costs	
Cost for the 46 Patients (USh)	329,000
Cost per Patient (USh)	7,100

The Clinical staff at Rwimi Health Center III are also involved in both HIV/AIDS and non-HIV/AIDS patients treatment, as the center is not a specialized AIDS clinic. Therefore, their time has to be apportioned to account for the number of patients in the project. The procedure is shown in Table 18 below. The average number of outpatient visits (which might also include AIDS patients from the sample in our analysis) per day is 68 (A. Alibhai, Personal Communication, December 17, 2007). The total number of visits is 8826 visits for the 6-month period at the Rwimi Health Center. The percentage of the total number of visits attributed to the Rwimi cohort is 3.51% (310 visits for 86 patients over 6 months). This percentage was multiplied by the total cost of staff for 6 months and then divided by 86 to obtain a cost per patient.

Table 18 Quantification and Valuation of Clinical Staff Time at Rwimi

Clinical Officers	2	420,000	840,000
Registered Nurses	3	400,000	1, 200, 000
Enrolled Nurses	2	300,000	600,000
Nursing Assistant	2	140,000	280,000
Health Assistant	1	280,000	280,000
Health Information Officer	1	240,000	240,000
Support Staff	1	20,000	20,000
Cost of staff for a Month			3,460,000
Cost of staff for 6 Months			20,760,000
Cost for 86 Patients for 6 Months	20,760,000 x 3.51 % = 729,163		729,000
Average Cost for 1 Patient for 6 Months	729,000/86 patients=8,500		8,500

Value

Estimates of public sector salary were obtained for the different types of clinical staff to evaluate the cost of time of the clinical staff on both arms of the experiment. Appendix G shows the estimates of the cost of time of different types of medical and clinical staff.

Assumptions Related to Quantification and Valuation of the Medical Staff

Baltussen *et al.* (2003) recommended that the value of scarce labor be evaluated at their true opportunity cost, which is the gross salary, plus any perks or fringe benefits associated with the position. However, the true value of scarce labor is underestimated in some countries (Baltussen *et al.*, 2003). In our analysis, the fringe benefits for the medical staff was not made available and our estimates of their costs which amounted to their salaries are undervalued. The salary for the JCRC doctors was obtained from personal communication (Personal Communication, A. Alibhai, December 17, 2007). The salaries of the clinical staff were obtained for the CB-DAART Rwimi staff only through personal communication and it was assumed that the salaries of clinical staff at JCRC were the same as their counterparts in Rwimi, although it is known that the salaries at JCRC are higher than at the Rwimi Health Center.

3.10.3 Patient's Time Cost

Quantity

The information needed to calculate the total time each individual patient of Rwimi spent on the CB-DAART program was categorized as follows:

1. Traveling time to and from the clinic (for scheduled and unscheduled visits)

2. Care Time (for scheduled and unscheduled visits including waiting time)

3. Time spent with the volunteer (equivalent to time volunteers spent with patients over the 6-month period)

4. Time spent with the treatment partners (equivalent to time treatment partners spent with patients over the 6-month period)

Different sources of information were used to obtain the elements needed to calculate the categories of time described above. The traveling time to and from the clinic was calculated from the distance in kilometers that the patients had to travel to the Rwimi Health Center III that was noted in most patients' files. It was assumed that in general, 5km was equivalent to 60 minutes of walking (Uganda Ministry of Health *et al.*, 2002). Such an assumption was necessary because the time for traveling to the clinic and care time, were bundled together for the JCRC cohort and were difficult to disentangle. Therefore, to make the patient time comparable for both cohorts a proxy for travel time was calculated for the Rwimi cohort.

The number of scheduled and unscheduled visits, which was obtained from the patients' files, was used in the calculation of traveling and care time. The waiting time for the patient was obtained by observation, which was confirmed by interviews with the clinical staff at Rwimi. The waiting time for patients is generally one hour at the Rwimi Health Center (Personal Communication, A.Clare, August 4, 2006). The care time for scheduled and unscheduled visits was obtained through interviewing the clinical officers and the doctors at Rwimi Health Center III, and was confirmed in an interview with Dr. Wamala, and is shown below in Table 19.

Table 19 Quantification of Patient Time at Rwimi for Scheduled Visits

Visit Type	Visit Description	Time Taken (Minutes)
Pre-visit		25
Visit 1		10-15
Visit 2A		10-15
Visit 2B	Lead-in Dose	10-15
Visit 3	Full Dose Initiation	5-10

Source: Personal Communication, J. Wamala, June 28, 2006.

As can be seen from Table 19, the visits of interest for which data was collected include Visits 2B to 3. Visit 4, which is the 6-month follow-up, has been assumed to also take 5-10 minutes similar to Visit 3. The total time for the three scheduled visits of interest for the 6 months has been calculated by taking the middle point of the time provided by Dr. Wamala. This gives a total time for scheduled visits of 27.5 minutes. The time for unscheduled visits was assumed to be 20 minutes, the same as the one reported by Dr. Tabusibwa at the JCRC clinic (Personal Communication, E.Tabusibwa, July 27, 2006). The time patients spent with volunteers was recorded by the volunteers in their patients' logs. As for the time the patients spent with treatment partners, it was assumed to be 5 minutes a day.

For the JCRC cohort, the total time spent by the patient seeking care was time for a return trip (to and from the health center) and care at the health center.

The distinction between unscheduled and scheduled visits was not made for the JCRC cohort because when information related to time and cost was collected in a socio-economic survey (SES), the distinction between the two types of visits was not made.

Therefore, it was impóssible for us to evaluate them differently as in the case of Rwimi. The question to evaluate quantity of time patients spent in seeking care are as follows:

"A.4 Time spent away from home (return and appointment)"

The socio-economic survey (SES) of the JCRC cohort was conducted by the Kabarole Research Center to collect baseline socio-economic data on the patients. The total number of visits for each patient during the 6 months was extracted from the patient's files.

Value

A minimum wage or average wage could have been used to value time. However, only 16.3% (Uganda Bureau of Statistics, 2007) of the working population in 2005-2006 was salaried through employment in the formal sector, rendering the minimum or average wage irrelevant to most patients and non-representative of the value of time of the population.

A measure of the opportunity cost of time of the volunteer was used to represent the opportunity cost of time of the Rwimi patients'. The volunteer cost of time was deemed the most appropriate and the closest approximation for the Rwimi's patients' opportunity cost of time. Calculations for this variable are presented in the section concerning the volunteer (section 3.9.5). The value per hour of time was 163 USh. The *National Household Survey 2005-2006* by the Ugandan Bureau of Statistics (2007) suggests that the urban monthly wage is approximately 3 times higher than the rural wage. Our data

suggest that the JCRC cohort has similar characteristics to other urban populations in Uganda (see chapter 4). Therefore, the wage per hour for the JCRC patient is assumed to be 352 USh per hour; three time the wage per hour of the rural, Rwimi cohort patients.

Total Costs

The total costs per patient were obtained by adding the waiting, traveling and caring time and then multiplying by the cost of time per hour for the CB-DAART Rwimi cohort. The total costs for the JCRC cohort were obtained by multiplying the total time taken seeking care by the calculated wage per hour.

Assumptions Related to the Quantification and Valuation of the Patient's Cost

I assumed that the patients worked 40 hours a week and that everybody has the same opportunity cost of time whether they worked or not in the period specified. In section 5.4, a sensitivity analysis with a work week of 60 hours is also performed to gauge the impact on the base case. I also assumed that all patients in the Rwimi cohort walked to the health center for medical visits. It was also assumed that all the unscheduled visits for both cohorts were related to HIV/AIDS. Therefore, the patients and medical staff time might have been overestimated in the care of the patients for HIV/AIDS, but is very unlikely especially for the JCRC cohort, which is a specialized AIDS clinic. However, if a patient in both cohorts visited any other health center for care of opportunistic diseases, this will not be recorded and therefore is not counted in the present evaluation. This is also an instance when the cost of patients' time might be underestimated.

3.10.4 Treatment Partner Cost

Quantity

The treatment partner costs included are:

1. Time for traveling to visit patients (for those who did not belong to the same household as the patient);

2. Time spent with patients.

An average travel time to visit patients was obtained for the treatment partners from a sub-sample of a survey of 114 treatment partners 26 of which did not live with the patients and were traveling to and from the patients' dwellings The question used to collect travel time information was as shown below. The question's meaning was lost in translation to Rutooro, the local language. According to the project manager, Arif Alibhai, the data collected in fact were for the time taken for a trip to and from the patient as opposed to just the time taken one way (A.Alibhai, Personal Communication, 2008).

> "28. What is the time spent traveling to visit patient (one way)? ------ minutes (write zero if you live in the same house)"

It was found that the average travel time for a trip to the patient's house for the group of treatment partners that were non-household members of the patients was 22.88 minutes. The care time was assumed to be 5 minutes per day (which includes signing off for taking one pill twice a day). The following tables (Tables 20 and 21) below show how

the amount of time the treatment partners spent on the HAART program has been evaluated to obtain a weighted average of time spent by treatment partners who traveled and those who do not.

Table 20 Typical Treatment Partner Time: Household Members (No Travel Time)

Care Time Per Day	5
Travel Time	0
Total Time for 6 Months (183 Days)	(183 * 5) = 915

Table 21 Typical Treatment Partner Time: Non-Household Members (Travel Time Included)

Care Time Per Day	5
Travel Time for a Trip	22.88
Total Time for 6 Months (183 Days) for 2 Trips a Day	(183 * 5) + (183 * 2 * 22.88) = 9,300

A weighted average of the amount of time spent on the program for the treatment partners was obtained by considering that 77% of them live with the patients and the rest do not. The total average time spent for a treatment partner is therefore 3,800 minutes as shown in Table 22.

Table 22 Typical Treatment Partner Time: Weighted Average Total Time

Weighted Average for Total Time for 6 Months (183 Days)	(88/114 x 915) + (26/114 x 9,300)= (0.77 x 915) + (0.33 x9,300)= 3,800

Value

To evaluate the cost of the treatment partners to the program, the concept of opportunity cost of time applies. The opportunity cost of time of the treatment partners was assumed to be the same as the opportunity cost of the volunteers, which is 163 USh. This calculation is shown in the section for volunteers (section 3.9.5).

Total Costs

The total 6-month cost for treatment partners per patient was obtained by multiplying the weighted average total time (3,800 minutes) by the average wage per hour (162USh) of the volunteers.

Assumptions Related to the Quantification and Valuation of Treatment Partners Time

It was assumed that the treatment partners never missed care time with the patient. We also assumed that it takes only five minutes to watch the pill-taking activity of the patient.

3.10.5 Volunteer Costs

Quantity

The costs associated with the volunteers are:

1. Time for traveling to patient,

2. Time spent with patients,

3. Time for monthly meeting,

4. Volunteer administrator and volunteer administration costs.

Volunteers fill in a time sheet every time they visit the patients, noting the time spent with the patients together with the travel time. It was assumed that the volunteers made 26 visits to the patient's house (6 months is equivalent to 26 weeks). The costs of bicycles, for the volunteers are not included because these costs represent a part payment of the time of the patients. Our approach involves the full economic costs of the volunteers. During the first 6 months, the volunteers met only 4 times mainly for administrative reasons, each meeting lasting 2 hours (Personal Communication, A.Alibhai, June 15, 2008). The cost of these meetings includes meals and transport for the volunteer- amounting to 5,000 USh per volunteer per session. This cost was apportioned over 185 patients. The cost of the volunteer administrator that manages the activities of the volunteers is also apportioned over the 185 patients in our project.

Value

The cost of time was evaluated at the household income level of a sample of volunteers (a total of 26 volunteers). The question used to elicit the values for the volunteers time is as follows:

B9. Please check the average monthly household income bracket that reflects how much cash income is earned by members of the household (all members, including yourself). Please select one category (amounts in shillings per month):

□Below 25,000 □25000-50000 □50001-75000 □75001-100000

□100001-150000 □150001-200000 □200001-300000 □300001-400000

□400001-500000 □Above 500000

The household incomes were collected as categories and therefore an average of all the income categories was obtained as shown below in Table 23.

Table 23 Average of Household Cash Income to Calculate the Volunteers` Time Cost

Household Cash Income Range (USh)	Mid-point (X)	Frequency (F)	X(F)
≤50000	25000	17	425,000
50001-75000	62500.5	3	188,000
75001-100000	87500.5	2	175,000
100001-150000	125000.5	2	250,000
150001-200000	175000.5	2	350,000
		Average	53,000

To calculate the costs per hour of the volunteer's time, a 40 hour work week was used. The salaries were inflated to 2007 Ugandan shillings using the Consumer Price Index (CPI) (Uganda Bureau of Statistics, 2008). The household income is divided by the

average number of adults in the household in order to get income for one person. However, in subsistence settings, households also receive in-kind income from products that they produce and consume. In order to calculate to calculate an opportunity cost of time that reflected the total income (i.e. cash and in-kind) of the volunteers (most of them farmers), a factor of cash to in-kind income was applied to the cash income reported by volunteers. This factor of in-kind to cash income of 0.48 was derived from data from the *Uganda National Household Survey 1999/2000: Report on the Crop Survey Module 1999* (Uganda Bureau of Statistics, 2002) as shown below in Table 24.

Table 24 Cash and In-Kind Income for Labor of Crop Farming (1999/2000)

Land Preparation, Planting and Weeding			
Paid Casual Workers	30,000	11000	
Harvesting			
Paid Casual Workers	18000	12000	
Land Preparation, Planting and Weeding			
Paid Casual Workers	23000	11000	
Harvesting			
Paid Casual Workers	16000	8000	
Total Amounts	87000	42000	0.48

Source: Uganda Bureau of Statistics, 2002

The cost of meals and transport per volunteer per training/administrative session was 5,000 USh (Personal Communication, Arif Alibhai, June 23, 2008). There were 41 volunteers (one volunteer dropped) (Personal Communication, Arif Alibhai, August 20, 2008)

The volunteer administrator salary has been made available to us through personal communication (Personal Communication, A.Alibhai, November 10, 2007).

Total Costs

The total cost for the volunteers' time was obtained by using the total time over the 6 months and multiplying by the cost per hour. The cost per patient associated with the volunteer administrator cost has been calculated by apportioning the costs over all the 185 patients in the project. The volunteer administration cost per patient was obtained by apportioning the total costs of volunteer administration for six months over the 185 patients.

3.10.6 Identifying, Quantifying and Evaluating Capital Outlays

The value of the capital outlays were calculated for the buildings for both the Rwimi and JCRC cohorts. The valuation was performed using two different methods, as different costs information was available for the two cohorts.

For Rwimi, the only information available was the cost of building the health center in 1989, which was 100 million USh (Personal Communication, A.Alibhai, October 31,

2007). An annuitization procedure is used to obtain an annual equivalent cost for the building using Equation 1 below from Drummond at al (2005).

$$K = E + E/(1+r) + ... + E/(1+r)^{n-1} \quad \text{..... (1)}$$

Where, *K= capital outlay or current cost of the building*

E= annual equivalent costs

r = interest rate = 3 %

n= Number of useful life years = 30

The original value of the health center was converted to 2007 USh by using the Composite CPI (Ugandan Bureau of Statistics, 2008). The CPI series unfortunately does not go back to 1989. Therefore, a linear interpolation for a CPI in 1989 was done with the years 2005-2006 as the base period as shown in Table 25. Using the CPI value from Table 25, the capital outlay value in 2007 USh was 331,000,000 USh.

Table 25 Calculation of the 1989 CPI (Base Period 2004-2005)

Items	
CPI in 2000	77.9
CPI in 2007	110.3
The change in Index in 8 years	32.4
A linear increase in CPI is assumed from 1989 to 2007- 19 years	
Increase in 8 Years	32.4
Increase in 19 Years	76.95
CPI in 1989	110.3-76.95= 33.35

Equation 1 was then applied to the current costs. It was assumed that the building had thirty useful life years.

The annual equivalent cost of the building is 16,400,000 USh. Therefore, for 6 months the value is 8,200,000 USh. To obtain the cost for the 86 patients, the percentage of total number of visits of these patients to the total number of visits at the Rwimi Health Center, 3.51%, was multiplied by the total cost for 6 months. The capital cost amounted to 3,300 USh per patient.

The calculation for the JCRC cohort used a different method, as only the rental information for a nearby residential building and the size of the JCRC building (568.5 square meter) was available (Personal Communication, A.Alibhai, November 17, 2007 and Personal Communication, Rwimi CB-DAART Project Staff, November 6, 2007). The 6 month rental price per m^2 for a nearby building was 5,400 USh. Therefore, the 6-

month cost for the JCRC building was estimated to be 18,400,000 USh. Considering that the percentage of the total number of visits for the 46 patients with respect to the total number of visits at the clinic was 2.38%, the average cost per patient over the 6 months is estimated to be 9,500 USh.

3.10.7 Training Costs

There were staff training costs at the Rwimi Health Center. The staff received a three-day course by a doctor. The salary of the doctor during those 3 days was counted as the training costs. The salary of the doctor was communicated to us through personal communication (Personal Communication, Rwimi CB-DAART Project Staff, October 8, 2007).

According to the contractual arrangement of the doctor at Rwimi, the doctor worked 48 hours per month for a salary of 600,000 USh (Personal Communication, Rwimi CB-DAART Project Staff, October 8, 2007) and the cost per hour of the doctors is 12500 USh. The training of the staff at Rwimi extended over three days and it was assumed that it was an 8-hour working day per day of training. The training costs of 300,000 USh for the 3 days were apportioned over the 185 patients in the project giving a cost per patient of 1,620 USh.

3.11 Sensitivity Analysis

As there are always some uncertainties around the parameters, a sensitivity analysis will be performed. A one-way sensitivity analysis will be performed where only one

parameter is varied while the others remain constant. Apart from testing from parameters uncertainty, one-way sensitivity analysis can be used to (Muennig, 2002):

a. Test the appropriateness of the decision-model (model validation)
b. Answer clinical or policy questions in addition to answering the primary questions of a study

The next chapter concentrates on socio-demographic analysis of the patient in the Rwimi and JCRC cohorts as well as of the volunteers and treatment partners in the CB-DAART. It brings context to our costs and outcomes analysis.

CHAPTER 4

SOCIAL AND DEMOGRAPHIC ANALYSIS

4.1 Objectives of Chapter 4

This section will be essentially an analysis of the socio-demographics of the individuals involved in the two cohorts in our study to understand:

1. Whether the socio-demographic characteristics of the patients in the Rwimi cohort are different from the patients of the JCRC cohort, and how they both compare to individuals who has tested positive for HIV in Uganda;
2. Whether the socio-demographic patterns of the patients uncover potential issues of interest to the operational management of the CB-DAART program at Rwimi;
3. The characteristics of the treatment partners and volunteers involved in the Rwimi community-based project;
4. Whether the socio-demographic patterns of the treatment partners and volunteers uncover potential issues of interest to the operational management of the community-based HAART program at Rwimi.

4.2 Data

Data was obtained from the patients' medical files for both cohorts. Also, for the JCRC cohort, information was obtained from a baseline socio-economic survey of the patients. Appropriate ethics approvals were obtained both in Canada and Uganda.

As is common with patient-level data, there were some variables for which we did not have information. Some of these gaps were filled by the project manager in Canada who provided information on missing cases for gender and age. Table 26 shows the number of cases for missing data for each variable in both cohorts. The table shows that there are only two variables that have major missing cases: *Distance to the Health Center* (14 cases) for the Rwimi cohort and *Occupation* (10 cases) for the JCRC cohort. For all the variables (except for Distance to the Health Center), only those patients for which complete information were available were included in the socio-demographic analysis. The missing data for distance travelled in both cohorts were replaced with the average of the distance travelled by the patients for whom this data were available in the respective cohort.

The socio-demographic analysis involves the comparison of the characteristics of the patients in both the Rwimi and the JCRC Cohorts to one another and to the Ugandan sero-behavioral population (USP) as uncovered in the 2004-2005 *Uganda HIV/AIDS Sero-Behavioral Survey* (USB) (Uganda Ministry of Health and ORC Macro, 2006), which among other subjects considers characteristics of HIV infected individuals across Uganda. However, because we do not have individual observations for the USB data, some comparisons with the Rwimi and JCRC cohorts will not be on a statistical basis.

Table 26 Missing Cases in Rwimi Patient-Level Data (*n*= 86 patients) and JCRC cohort (*n*=46)

Characteristics	Rwimi		JCRC	
	Total Available	Total Missing	Total Available	Total Missing
Gender				
Male	32	0	18	0
Female	54	0	28	0
Age				
Male	32	0	18	0
Female	54	0	28	0
Marital Status				
Male	32	0	16	2
Female	54	0	24	4
Education				
Male	32	0	15	3
Female	54	0	26	2
Occupation				
Male	29	3	15	3
Female	52	2	21	7
Distance to the Health Center				
Male	24	8	18	0
Female	48	6	24	4
Mode of Transport				
Male	N/A	N/A	18	0
Female	N/A	N/A	24	4

4.3 Comparisons between the Rwimi and JCRC cohorts, and the Ugandan HIV Sero-prevalent Population

In the comparisons below, we investigate differences in the socio-demographic characteristics in the cohorts compared to each other and compared to the Ugandan HIV/AIDS sero-positive population (USP) as portrayed in the USB. Due to limitations in data, the latter comparison is only made in the sections: *Participation by Gender and Marital Status, Participation by Age, Participation by Education and Participation by Occupation* (only employment versus non-employment is compared). We also discuss what these characteristics imply for the operational management of the community-based HAART program at Rwimi.

4.3.1 Participation by Gender and Marital Status

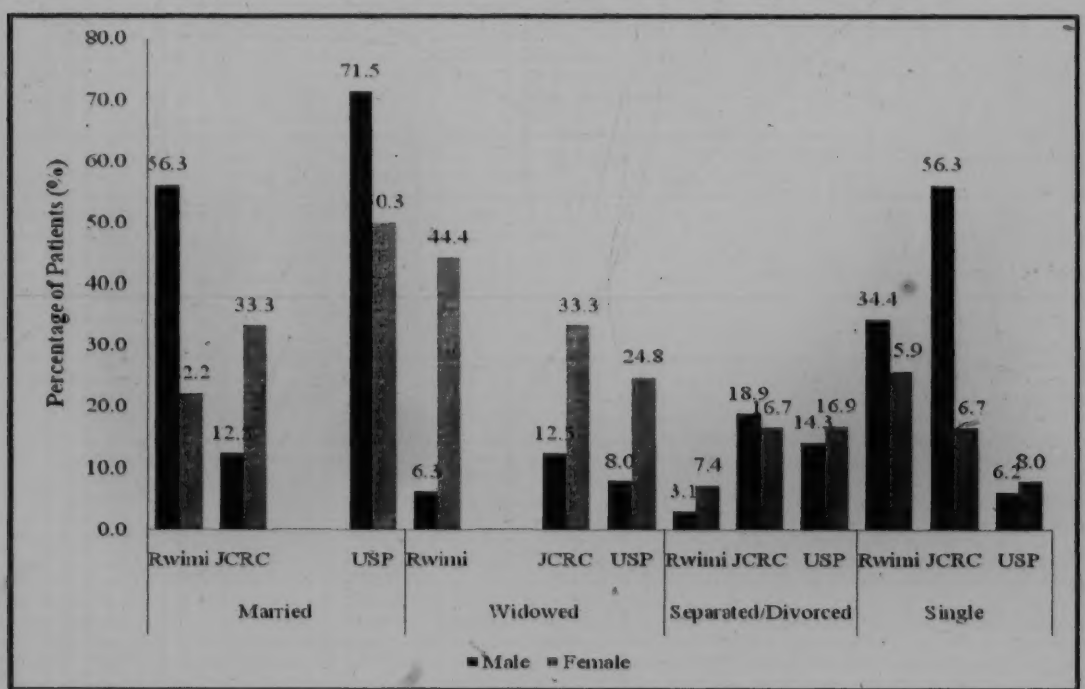
In the Rwimi cohort, the participation rates for women and men are 62.8% and 37.2% respectively. In the JCRC cohort, the participation rates of women and men are 60.9 % and 39.1 % respectively. A chi-square test showed that there was no difference in gender composition between the two cohorts (χ^2 = 0.047, p= 0.829). The corresponding percentage of infected individuals for the USP aged 15-59 years, are 63.4 % for women and 36.6 % for men.[1]

Despite the fact that the participation rates of genders in both cohorts concur with Ugandan prevalence data, there are claims in Uganda that there are pre-existing gender

[1] Percentages were calculated from data contained in Ministry of Health and ORC Macro (2006).

inequalities in accessing ARVs (Kivumbi, 2008). At first glance, our data do not support such claims as the overall gender-wise participation rate mirrors the prevalence rate in Uganda. However, a closer analysis of our data suggests that while overall, women might not have restricted access to ARVs; it is possible that there might be categories of women in the Rwimi cohort that have restricted access. Figure 5 shows the participation rates in both cohorts and the Ugandan infection rate by gender and marital status.

Figure 5 Percentage Participation and Prevalence by Gender and Marital Status for the Two Cohorts and the Ugandan Sero-prevalent Population Respectively



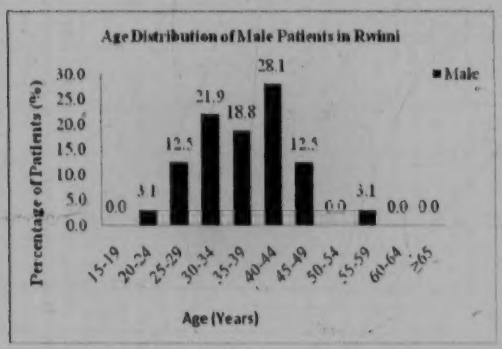
Note: USP is Ugandan sero-positive population. Percentages for the USP were calculated from data contained in Ministry of Health and ORC Macro (2006)

Most striking are the results for the married category. Although, the infected married female population in Uganda is 70% as large as the married male population, the participation rate of married females at Rwimi was only 40% of the participation rate of married males. These results suggest that married women in Rwimi were disadvantaged in receiving ARVS. On the other hand, the participation rate of married women in the JCRC cohort is 2.7 times more than the men's. Although we do not know why these differences have occurred, the implications of married women having less access in the rural setting warrants further investigation.

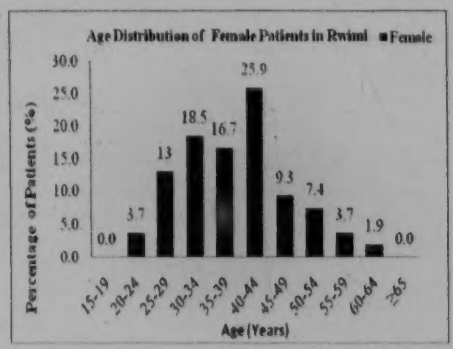
4.3.2 Participation by Age

Figure 6 discloses that sero-positive people in Uganda and in both cohorts with HIV/AIDS are largely in age groups that span the twenties through the forties. These age groups represent individuals in their prime productive years, economically and socially, and include individuals who will likely leave behind vulnerable orphans when they die. More than 70% of both men and women described themselves as caregivers.

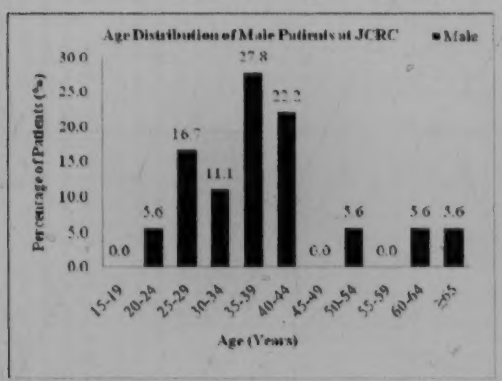
Figure 6 Age Distributions of Individuals Infected with HIV/AIDS by Age Categories in the Rwimi- (a), (b) and JCRC- (c), (d) Patients Cohorts and USP- (e), (f)



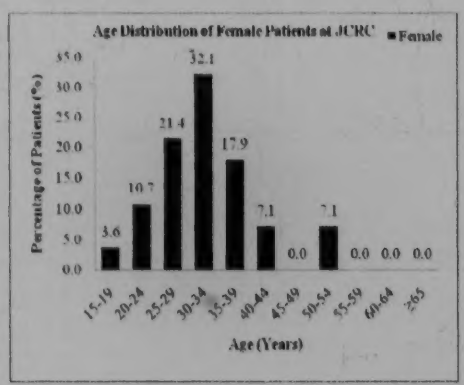
(a)



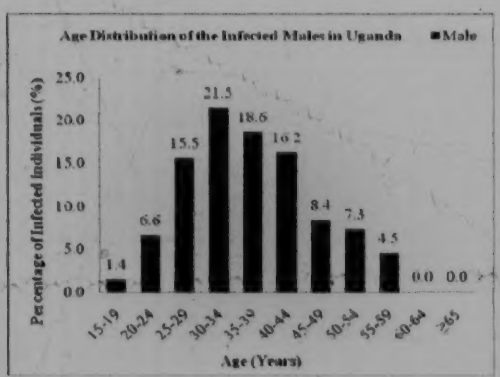
(b)



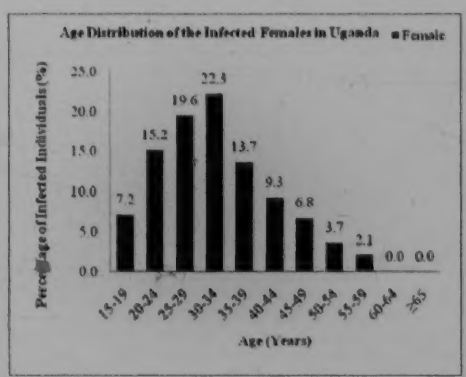
(c)



(d)



(e)



(f)

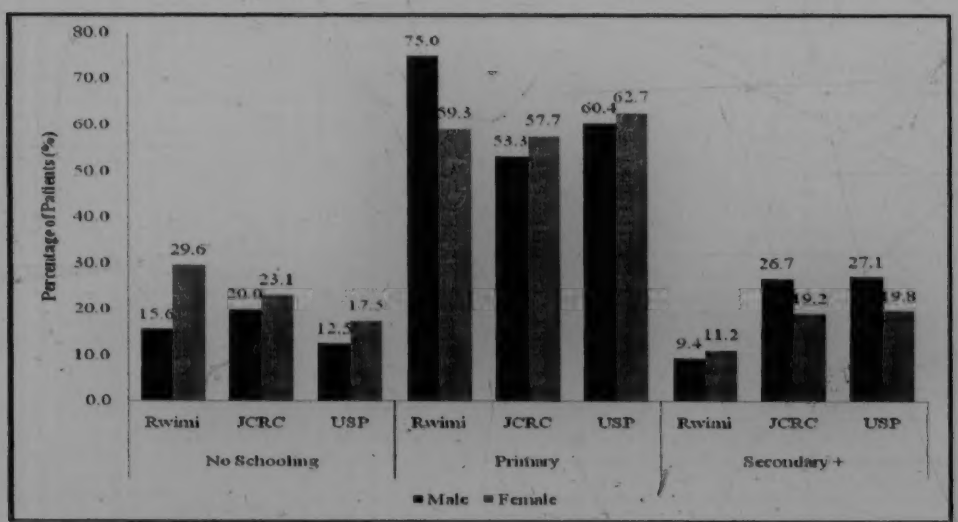
Figure 6 also reveals that neither of the cohorts', nor the USP population's age distributions appear to be normally distributed, with higher percentages in the lower age classes. Because of the non-normality of these distributions, Mann Whitney tests were used to test for age and gender differences. With respect to ages of each gender in the two cohorts, Mann Whitney tests show that differences in the age distributions of men and women in the Rwimi cohort are not statistically significant (z = -0.487, p= 0.626), while there are significant differences in the JCRC cohort, with women being younger than men (z =-2.301, p= 0.021). Combining males and females, we find that the median age of the Rwimi cohort is higher than for the JCRC cohort, with a Mann Whitney test indicating a significant difference between the distributions (z = -2.710, p=0.007). A visual inspection of the USP data suggests that there are some age class gaps in the study cohorts, but that in general, the age distributions of AIDS infected Ugandans are similar to the distribution of ages in the two study cohorts.

4.3.3 Participation by Education

Education is an important determinant in HIV/AIDS infection as it may have a "protective effect" against infection (Corno and de Walque, 2007). But many people in Uganda do not proceed past primary education. Figure 7 shows that in both study cohorts and the USP data, more than 70 % of the infected individuals for both genders have either no schooling or only primary education.

In order to test for statistical associations, data in Figure 7 were combined into two schooling categories; *no schooling, and at least some schooling* (which included the primary and secondary+ data). A Fisher Exact test was performed to assess whether there was a statistically significant association between the percentage of infected individuals with no schooling and those with at least some education between the two cohorts, and it showed that there was no significant association (p=0.826). A Fisher Exact test to test for an association between gender and the two categories (*no schooling and at least some schooling*) mentioned above showed that there were none that was statistically significant in the Rwimi cohort (p= 0.144) or for the JCRC cohort (p= 1.00).

Figure 7 Education in the Rwimi and JCRC Cohorts Compared to Education Level in USP



Notes: For the Rwimi and JCRC data, Secondary and Post Secondary schooling were combined order to make their education categories comparable to the USP data.

4.3.4 Participation by Occupation

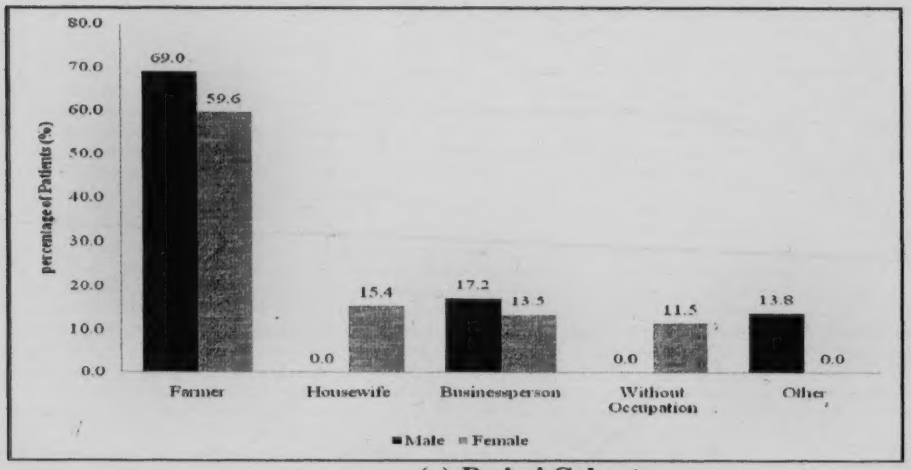
Unfortunately, a lack of occupational information in the USP data limits our comparisons in this section, though the percentage of working versus not working individuals will be compared. Moreover, because the Rwimi and JCRC cohorts are located, respectively, in rural and urban settings, the categories of occupations are necessarily different. In Figure 8, panels (a) and (b) show, distributions of participants by occupation in Rwimi and JCRC respectively.

In the USP population, most people are working (85% of men and 69% of women). Figures 8 (a) and 8 (b) reflect this same general pattern for both cohorts. Figure 8 (a) shows that the Rwimi cohort is typical of rural Uganda as most of the patients are involved in farming. However, in Figure 8 (b), the JCRC cohort occupations reveal an urban population where less than 30% of both men and women are involved in farming. A chi-square test revealed that there are significant differences regarding involvement in farming between the two cohorts ($\chi^2 = 9.85$, $p = 0.002$).

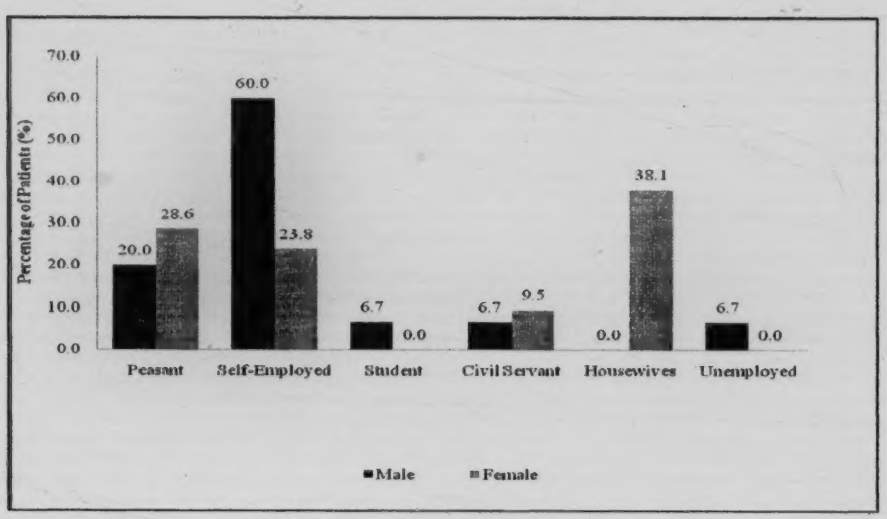
Both cohorts are typical of Uganda regarding men having more possibilities than women to engage in non-farming activities, as can be deduced from the higher percentage of men involved in business activities, self-employment and other activities. These gender-derived differences are consistent with findings in the 2002 Ugandan census.

> "Women are predominantly engaged in subsistence agriculture and elsewhere as unpaid family workers." (Uganda Bureau of Statistics, 2006)

Figure 8 Occupations in the (a) Rwimi and (b) JCRC Cohorts



(a) Rwimi Cohort



(b) JCRC Cohort

4.3.5 Participation by Distance to the Health Facility

In Uganda living within five kilometers of a health facility is the benchmark for geographical accessibility of health care (Uganda Ministry of Health *et al.*, 2002):

> (...), a 1993 inventory of health units found that geographical access to health care is limited to 49 percent of the population, i.e. population living within 5 kilometers (about one hour's walking distance) of a health facility providing both curative and preventive health services (World Bank quoting Ministry of Health).*pg 2*

Thieren (2005) specifies that "geographical accessibility will vary according to local means of transportation, as well as the local topography." Moreover, distance can translate into costs such as traveling expenses and time away from work. In Uganda, some individuals cannot travel to distant health centers for HIV/AIDS treatment as it creates financial barriers (transport costs) affecting the ability of the patients to afford those services (Hardon *et al.*, 2007). Consequently, the community-based program can facilitate inclusion by improving the geographical and financial accessibility of the HAART program.

Table 27 below shows that the median distance travelled for care for the patients in the Rwimi cohort is less than five kilometers (4.0 kilometers), whereas the median for the patients in the JCRC cohort is 8.0 kilometers, which is 1.6 times the benchmark of

geographical accessibility. A Mann-Whitney test shows that there is a statistically significant difference between the distance travelled by the patients in the Rwimi cohort and the JCRC cohort (z=-5.523, p=0.000). For the Rwimi cohort, the furthest distance traveled by a patient was 2.8 times the 5 kilometers benchmark for geographical accessibility whereas for the JCRC the furthest distance traveled was 6.4 times the benchmark.

Table 27 Distances to Rwimi Health Center and JCRC AIDS Clinic, Gender and Statistics

Rwimi-Male	4.3	0.5	14.0
Rwimi-Female	4.0	0.4	13.0
JCRC-Male	7.5	3.0	32.0
JCRC-Female	10.0	2.0	30.0
Rwimi	4.0	0.4	14.0
JCRC	8.0	2.0	32.0

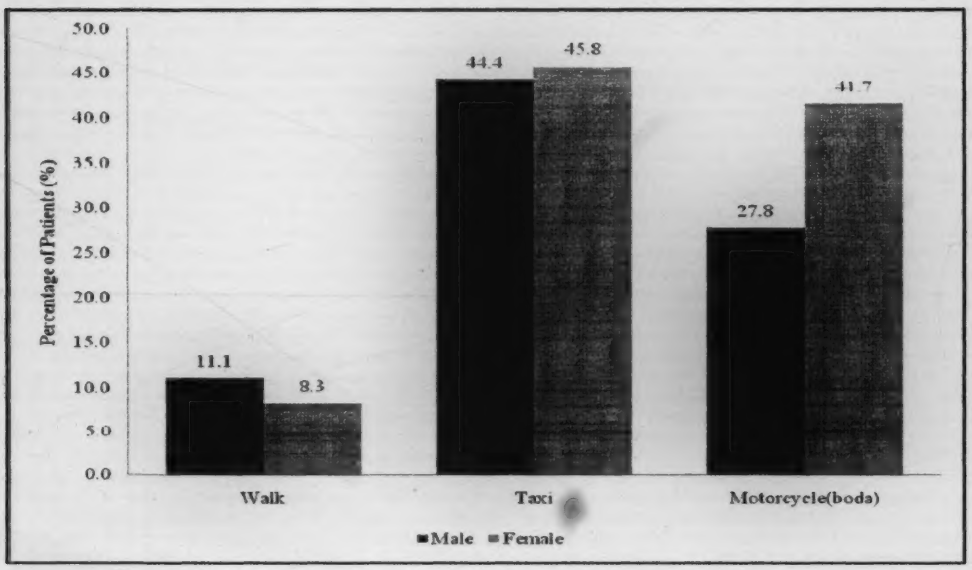
The distance traveled by the patients to access care at the JCRC illustrates how the community-based program improves access to HIV/AIDS treatment. The distances traveled to access HIV/AIDS care for the JCRC communicates the need of more decentralized services such as the community-based program that are closer to where the services are needed.

Examining distances traveled by gender (Table 27) discloses that there are some differences in the medians between males and females in Rwimi and JCRC. However, Mann-Whitney tests show that these differences are not statistically significant either for Rwimi ($z = -1.317$, $p=0.188$) or for JCRC ($z=-0.632$, $p= 0.527$).

4.3.6 Travel Mode: JCRC Cohort

The variable *Travel mode* was only available for the JCRC cohort. Figure 9 shows that the most common mode of transport for the JCRC cohort (More than 70% for both women and men) was taxis and bodas (bodas are hired motorcycles). The treatment program at JCRC requires monthly appointments, and paying for taxis and bodas each month could raise financial issues for the family. Questions also arise as to whether the patients will be able to afford the time away from work every month.

Figure 9 Travel Modes in the JCRC Cohort



In a survey by Hardon *et al.* (2007), transport cost was found to be an important factor in poor adherence of the patients to HAART in Uganda.

'I have very many people in the village, they are dying because they don't have money to transport themselves to the hospital. You need to have this money monthly. (...)' (Hardon, 2007)

Therefore, transport costs may be an important consideration in deciding which type of program fits the typical Ugandan.

4.4 Socio-demographic Analysis of Treatment Partners and Volunteers involved in the Rwimi Community-Based HAART Program

In addition to characteristics of the patients, we are also interested in characterizing the volunteers that distribute the pills and monitor adherence, and the treatment partners that must watch the patient take pills twice a day. Extensive analysis is ongoing (at the time of writing) on the characteristics of the volunteers and treatment partners by collaborators on this project. Therefore, the following two sections will only give a brief summary of the characteristics of the volunteers and treatment partners in the form of tables, findings that originate from the works of collaborators. Salient features are commented on only if they have direct bearing to operational management.

4.4.1 Treatment Partners

Table 28 describes the characteristics of a sample of the treatment partners. It is clear that more women (61%) are involved as treatment partners.

Table 28 Characteristics of Treatment Partners

Demographic characteristics		Percentage
Gender	Male	38.0
	Female	61.0
Education	Primary	66.0
Relationship	Family	85.5
	Non-family	13.0
Marital Status	Married	79.2
	Other	20.8
Location	Live with Patient	71.0
ARVs Knowledge	Nothing	14.0
	Know a 'little"	78.0
	Know a "lot'	8.0

Source: Personal Communication A. Kaler, May 7, 2007 (n=113)

The majority of the treatment partners are related to the patient (85.5%). Approximately, 54.5% of the sample is women who have family ties with the patients: mothers (23.0%), wives (13.0%), daughters (15.0%) and sisters (3.5%).

A notable point is that a majority (71.0%) of the treatment partners live with the patients. The assignments related to the treatment partner's work are likely easier to handle when living with the patients as no traveling is required twice a day for 365 days a year.

A number of children (19.0% of all the treatment partners) were also involved as treatment partners in the community-based project at Rwimi. A study by Hardon *et al.* (2007) showed that children were important in maintaining their parents' adherence to HAART in three African countries namely Bostwana, Tanzania and Uganda.

> Our studies suggest that, in all three countries, children play a role in reminding their parents to take their pills. Adherence support could recognize the potential role of children in adherence support and provide them with adequate information on ART, for example through school education programmes, to empower them in their role as treatment supporters.(Hardon *et al.*, 2007)

Most of the treatment partners are also married individuals. A majority of the treatment partners attended primary school (66.0%) and declared to have "little knowledge of ARVs".

4.4.2 Volunteers

Table 29 shows the socio-demographic characteristics of the volunteers. The socio-demographic profile of the volunteers shows that a majority of the volunteers are farmers just like the patients in Rwimi.

Table 29 Characteristics of Volunteers (*n*=26)

Demographic characteristics		Percentage
Gender	**Male**	57.7
	Female	42.3
Education	Primary	57.7
	Secondary	26.9
	Post Secondary	15.4
Occupation	Farmer	61.5
	Non-farmer	38.5
Household Cash Income (monthly)	≤50000	65.4
	50001-75000	11.5
	75001-100000	7.7
	100001-150000	7.7
	150001-200000	7.7
Marital Status	Married	79.2
	Other	20.8

A noteworthy point is the fact that, despite women forming the majority of the patients, the majority of the volunteers are men. Cultural accessibility to health care has been a point raised in a technical document by Thieren (2005) on what accessibility means, exemplifying it as follows:

"Can women use reproductive health services if all the physicians in the facility are males?"

This suggests that male providers of health services (in this case the volunteers) that are related to reproductive issues might bear the imprint of cultural taboos. Women suffering from AIDS often also suffer from reproductive system diseases such as vaginal candidiasis. It is possible that women might not want to report such cases of opportunistic infections to the volunteer who are supposed to monitor the well-being of the patients by being involved in opportunistic infection diagnosis and management.

Most volunteers are married individuals (79.2%). A majority of the volunteers attended primary school (57.7%) and more than 25.0% of the volunteers attended secondary schools. Most of the volunteers are farmers (61.5%) and earn monthly household cash income of less than 50,000 USh (65.4%).

4.5 Summary

Both the Rwimi and the JCRC cohorts exhibit similarities to the Ugandan sero-positive Population and to the general Ugandan population. The Rwimi and the JCRC cohorts

share similarities but also some differences with respect to age of the patients and their employment. These differences can lead to confounding. The socio-demographic analysis also informs us on potential operational management issues such as a high dependency on donation of time by the community and cultural accessibility with respect to male volunteers providing services to women.

CHAPTER 5

COST CONSEQUENCES ANALYSIS

"Therefore the appropriate way to judge economic evaluations is not whether they embody some ultimate 'truth', but whether they lead to a better decision than would be made in their absence." (Drummond and Sculpher, 2003)

The socio-demographic analysis in the previous chapter allows us to add context to the health outcomes and cost analysis in this chapter. This chapter builds on the socio-demographic analysis in Chapter 4 to make interpretations of the outcomes and costs. For example, a 100% virological success for a CB-DAART program for prison in-mates cannot be compared to an 80% virological success obtained in a community-based HAART program in rural Uganda.

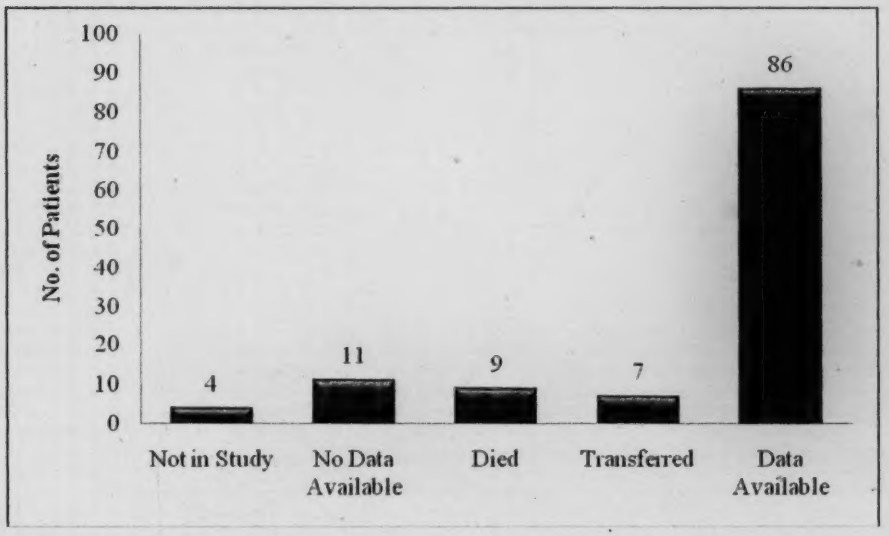
5.1 Health Outcomes

The primary health outcome that is considered in this thesis is the 6-month viral load count of the patients in our analysis. This is our benchmark for treatment success. Statistical difference for mortality rates together with the viral counts at 6 months will also be presented for the two cohorts, but these results were obtained from sub-samples of the two cohorts different from the sub-samples used in this thesis.

5.1.1 Rwimi Cohort: Primary Outcome

This section will discuss the sampling of the patients in the Rwimi cohort, which was done with respect to availability of data on the viral load at 6 months. Figure 10 below shows how we reached the sample of 86 patients used in our analysis. To analyze the data on outcomes, we took a complete case analysis approach.

Figure 10 Sampling Details for Rwimi Cohort



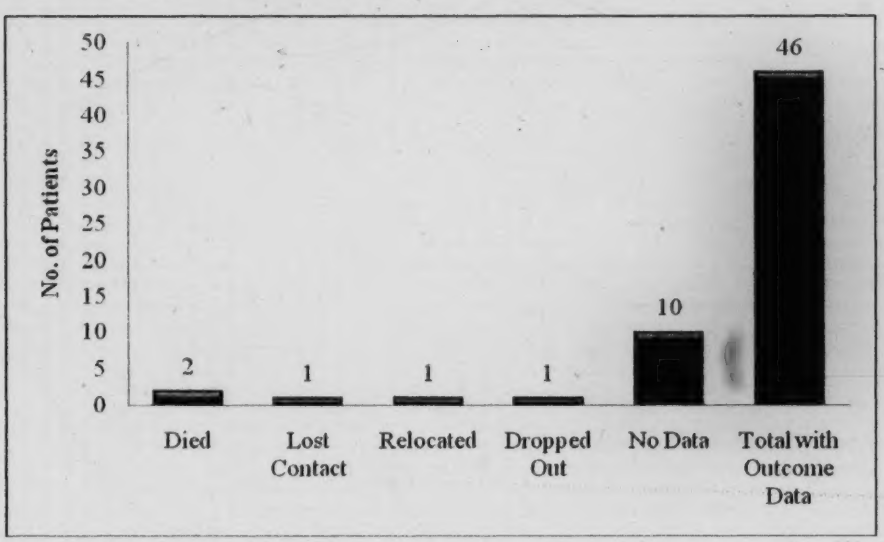
As discussed in Chapter 3, the primary measure of health outcome is the viral load evaluated at 6 months. Treatment success is a viral load of less than 400 viruses per ml of blood and treatment failure being a viral load of more than 400 viruses. The program enjoys a high success rate of 88.4% of the enrolled. The investigators on the project expected a success rate of 80% (Kipp *et al.*, 2004) and the level of 88.4% clearly exceeded expectations.

The results show that it is important to continue to investigate this model in other similar settings that use the same measure of success in order to benchmark the results and investigate how generalizable our results may be. There is a gap in the literature on the community-based delivery of HAART in developing countries.

5.1.2 JCRC Cohort: Primary Outcome

The same procedures used in Rwimi were applied to obtain the sample of interest to our analysis. Figure 11 shows how the sample of 46 patients was reached. A computer-generated random sample of 61 patients was derived from the larger sample of 200 patients for JCRC.

Figure 11 Sampling Details for JCRC Cohort



The results show that the success rate for the JCRC cohort is high, as 96% of patients achieved a viral load of less than 400 virus copies per ml of blood.

5.1.3 Comparing the JCRC Cohort to the Rwimi Cohort

Comparing the Initial CD-4 Counts

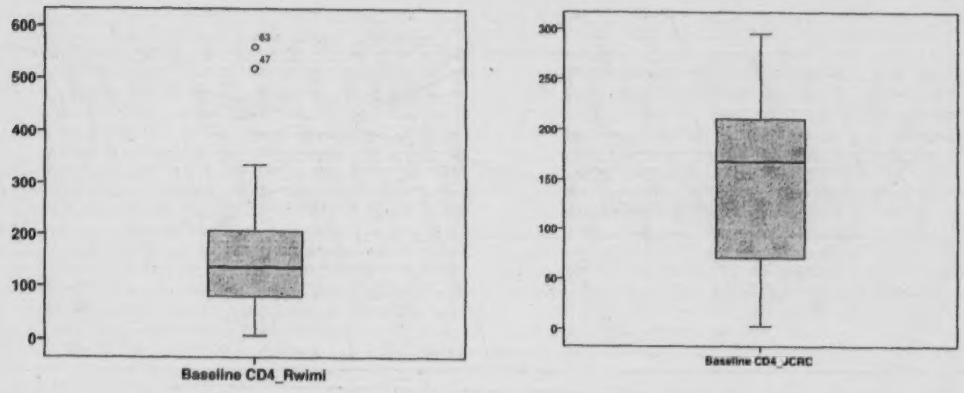
The initial CD-4 is a very important clinical measure that affects the prognostic of patients and how well they will succeed in their treatment. In general, the higher the count of baseline CD-4 per ml of blood, the better the prognostics is for the patient. From the Table 30 below, we can see that for both cohorts, more than 60% of the patients are in the two highest categories of CD-4 counts.

Table 30 Distribution of the Patients among the Initial CD-4 Level

Categories of CD-4 Level (Count per ml f blood)	Percentage of Sample (JCRC)	Percentage of Sample (Rwimi)
<50	19.57	13.95
50-100	10.87	22.09
100-200	34.78	38.37
>200	34.78	25.58
Total	100.00	100.00

The Figure 12 (a) and (b) show that the spread of the two distributions bear similarities.

Figure 12 Box plots of the CD-4 Counts for both Cohorts



(a) **(b)**

It can be observed that in both groups, most individuals are under the 200 CD-4 cells per ml of blood as this is the criteria for selection. Those who were above the 200 CD-4 cell limits were in either WHO Stages 3 or 4, which are two other criteria used for enrolment into the HAART program. The Rwimi cohort also has two outliers. A logistic regression of larger sub-samples of the two cohorts showed that there was no statistically significant difference between the two cohorts in their initial CD-4 count level (Alibhai *et al.*, 2008).

Comparing Virological Success and Mortality rates at 6 months: the Primary and Secondary Biological Outcomes

To determine whether the virological success outcomes were different, a logistic regression using larger samples of both groups showed that there was no relationship between treatment groups and viral loads and therefore it is concluded that there was no difference between the two groups for virological success in treatment at 6 months

(Alibhai *et al.*, 2008). The mortality rates have also been confirmed to be similar in both cohorts (Alibhai *et al.*, 2008).

5.2 Cost Analysis for the Rwimi and JCRC Cohorts

5.2.1 Costing Models

There were two distinct costing models used to evaluate the societal costs in both cohorts as shown in Table 31. It summarizes the components of both costing models as well as their sources of data. The two costing models consist of common components such as ARV and non-ARV drugs, medical staff costs, patients' costs, and capital costs. The Rwimi costing model has some unique components, which are training and volunteer administration cost, treatment and volunteer costs.

Table 31 Costing Models

	Rwimi Costing Model		JCRC Costing Model	
	Components	Sources of Data	Components	Sources of Data
1	ARV Drugs	Patients' Files, Quality Chemicals Limited	ARV Drugs	Patients' Files, Quality Chemicals Limited
2	Non-ARV Drugs	Patients' Files, NMS, JMS	Non-ARV Drugs	Patients' Files, NMS, JMS
3	Medical Staff	Personal Communication	Medical Staff	Personal Communication
4	Patient's Time	Patient's Files	Patient's Time	Patient's Files
5	Capital Cost	Personal Communication	Capital Cost	Personal Communication
6	Training and Volunteer Administration Cost	Personal Communication		
7	Treatment Partner	Treatment Partner Survey		
8	Volunteer	Volunteer Survey		

The costing models try to capture the essence of the processes in both HAART programs. The following sections uncover the results of the quantification and evaluation described in Chapter 3.

5.2.2 Cost of ARV Drugs

The ARV drugs cost is one of the cost components common to both cohorts. There were no known missing values for the ARV drugs in both cohorts. Information was available on all the types of ARV drugs prescribed to the patients. Table 32 shows that for the Rwimi cohorts, out of the 86 patients, there were only 3 patients that changed regimens. For the JCRC cohorts, there were 7 cases of patients who changed regimens.

The typical ARV regimen for both HAART programs is the T-30 regimen and it costs 114,500 USh for the first 6 months of treatment. The calculation for the typical regimen is shown in Table 1 of Appendix C. The cost for a day's prescription for the lead-in dose was calculated using different price data from the data used to cost a day's prescription for a full dose. This is because the wholesale price for a full dose for a day's prescription for 30 days comprises of two units of Stadivudine, two units of Lamivudine and two units of Nevirapine. In order to calculate the cost of one dose, the price of the of the T-30 regimen for 30 days is divided by 60 (19000 USh divided by 60 giving a cost of 317 USh per dose and therefore the cost of the prescription per day was 633 USh). However, the fact that in the lead-in dose, Nevirapine is taken only once a day precludes the use of the wholesale price of a full dose of T-30. Therefore, the individual cost for one unit of each drug of the lead-in dose for the T-30 regimen was used to calculate the cost of the lead in dose as shown in Tables 1 and 2 in Appendix B.

The total costs for the 83 patients in Rwimi on the T-30 regimen were 9,500,000 USh, while for the 3 patients that changed regimen in Rwimi it was 1,010,000 USh. The total costs for the 39 patients in JCRC on the T-30 regimen was 4,500,000 USh while for the 7 patients that changed regimen in JCRC it was 2,300,000 USh.

Table 32 ARV Drugs Cost in Both Cohorts for 6 Months

Components	Rwimi			JCRC		
	Number of Patients	Cost of Regimen (USh)	Total Cost (USh)	Number of Patients	Cost of Regimen	Total Cost (USh)
Patients with Normal Regimen	83	115,000	9,500,000	39	115,000	4,500,000
Patients with Changed Regimens	3	(281,000 + 327,000 + 402, 000)	1,010,000	7	(402,000 + 210,000 + 233,000 + 402, + 233,000 + 402,000 + 373,000)	2,300,000
Total	86		10,500,000	46		6,700,000

Appendices B and C show the individual calculations for both the patients with the typical regimen and the patients who changed regimens in both cohorts. Table 33 shows that the average cost per patients for ARV drugs in Rwimi is lower than for the JCRC patients.

Table 33 Cost of ARV Drugs per Patient

Components	Rwimi	JCRC
Average Cost of ARV Drugs (USh)	122,000	146,000
Cost of the Typical Regimen (USh)	115,000	115,000
Cost of Changed Regimen- Lowest (USh)	281,000	210,000
Cost of Changed Regimen- Average (USh)	337,000	322,000
Cost of Changed Regimen- Highest (USh)	402,000	402,000

For Rwimi, the lowest cost for patients that switched regimen is 2.5 times the cost of the typical regimen and the highest cost for a patient that switched regimen was 3.5 times of the typical regimen. For the JCRC cohort, the lowest cost for a patient that switched regimen was 1.8 times the cost of a typical regimen and the highest cost of regimen for patients that changed regimens was 3.5 times the typical regimen. The average cost of ARV drugs is higher in JCRC because there were more individuals that changed regimen.

In the face of the high costs of changing regimen, it is important to control the factors that cause the switch.

5.2.3 Costs of Non-ARV Drugs

The non-ARV drugs refer to the drugs that are prescribed in case of opportunistic infections and also other related medical conditions. The data for the variable *Non-ARV Drugs* was the variable that suffered the most from missing values in the study. For the Rwimi cohort, there were 68 missing cases that the author was able to identify. The missing cases affected 39 patients. The costs for the missing cases (the name of the drugs could not be identified at all due to illegibility) were replaced by the average of the total costs of all the prescriptions (except prescription for tuberculosis treatment as explained in section 3.10.1). Those drugs names that could be identified (Benzathine (3 cases), Dapsone (1 case) and Ventolin (1 case)) but not their price were not included in the base case using the average of the total costs of all prescriptions as it was concluded that it might do more harm than good. If we were to replace the cost by the average of known drugs costs then the cost of the drugs not included amounts to only around 20,000 USh difference. For the JCRC cohort, there were only 6 cases of missing data. These cases concerned 6 patients where the drugs names were known but not the price.

Table 34 shows the total costs, the average costs and the lowest and highest costs of all non-ARV drug prescriptions per patient for both cohorts.

Table 34 Costs of Non-ARV Drugs for 6 Months

Components	Rwimi	JCRC
Total costs (USh)	1,001,000	753,000
Minimum (per Patient) (USh)	4,300	4,300
Average (per Patient) (USh)	11,600	16,400
Maximum (per Patient) (Ush)	97,000	106,000
Median (Ush)	6300	7500
IQR	6600	9600

The lowest total cost of all prescriptions for the patients in Rwimi and JCRC is 4300 USh. It is the cost of Septrin prophylaxis (Cotrimoxazole) for 6 months. It means that those patients likely did not have any occurrences of opportunistic infections and therefore did not require any additional medications. Thirteen patients in the Rwimi cohort and 8 patients in the JCRC cohort belonged to this category. The highest cost in both cohorts involves anti-tuberculosis prescriptions, which amounted to 85,000 USh out of the 97,000 USh- highest total costs for all prescriptions for a patient in Rwimi, and 106,000 USh- highest total costs for all prescriptions for a patient in JCRC. Tuberculosis afflictions can drastically increase the costs of the non-ARV prescriptions for the patients. Therefore, a holistic approach to the patients' treatment is important, especially with regard to the disease ecology as it is known that tuberculosis infection is increased in poorly ventilated areas. The volunteers who visit the homes of the patients in the Rwimi cohort can play a pivotal role in educating patients. The average total cost of all

prescriptions for the Rwimi cohort (12,000 USh) is lower than for the JCRC cohort (16,000 USh).

5.2.4 Doctor's Time and Other Medical Staff Time

The medical staff time is yet another cost component that is common to both costing models as shown in Table 31. The medical staff cost for the patients in both cohorts has been apportioned by using a ratio of effective visits for the patients in our analysis to the effective visits of all patients at the respective health facility during 6 months.

For the Rwimi cohort, there was only the clinical staff cost included. At a Health Center III (Rwimi Health Center III) only clinical officers and nurses are present. There are no doctors. The doctors present at the Rwimi Health Center during the implementation of the program were for training purposes and the associated costs have been valuated elsewhere. Table 35 shows the cost of clinical staff for the Rwimi cohort.

Table 35 Cost Per Patient of Clinical Staff for 6 Months - Rwimi Cohort

Staff Configuration			
Types	*Quantity*	*Costs (USh)*	*Total (USh))*
Clinical Officers	2	420,000	840,000
Registered Nurses	3	400,000	1, 200, 000
Enrolled Nurses	2	300,000	600,000
Nursing Assistant	2	140,000	280,000
Health Assistant	1	280,000	280,000
Health Information Officer	1	240,000	240,000
Support Staff	1	20,000	20,000
Cost for a Month (USh)			3,460,000
Cost for 6 Months	6	3,460,000	20,760,000
Cost for 86 Patients (3.51% of Total Visits) for 6 Months (USh)			729,000
Average Cost for 1 Patient for 6 Months (USh)			8,500

The cost for the 86 patients for 6 months is 729,000 USh. The cost per patient for 6 months is 8,500

The cost for the doctors at the JCRC clinic has been calculated as shown in Table 36. The doctors cost is included for the JCRC cohort as they are an integral part of the HAART program and are not present for training purposes only. Training at the JCRC clinic is provided through workshops and seminars (Personal Communication, A.Gwaita, June 08, 2008).

Table 36 Doctors' Costs per Patient for 6 Months- JCRC Cohort

Costs	
Cost for the 46 Patients (USh)	715,000
Cost per Patient (USh)	16,000

The cost for the 46 patients for 6 months is 715,000 USh. The average cost per patient for 6 months is 16,000 USh as shown in Table 36. Table 37 shows the calculation for the clinical staff time at the JCRC clinic.

Table 37 Clinical Staff Costs per Patient for 6 Months- JCRC Cohort

Items	
Percentage of Visits for the 46 Patients out of the Total(%)	2.38
Cost for the 46 Patients (USh)	(2.38 % x 13,800,000)= 329,000
Cost per Patient (USh)	7,100

The total cost for 6 months is 329,000 USh and the average cost per patient for 6 months is 7100 USh. Table 38 depicts the comparison of clinical staff costs between the two cohorts.

Table 38 Comparing Staff Costs in Both Cohorts

Components	Rwimi (n= 86) USh	JCRC (n=46) USh
Doctors Cost for 6 months	0	30,000,000
Clinical Staff Cost for 6 months	20,760,000	13,800,000
Total Staff Cost for 6 months	20,760,000	43,800,000
Total Number of Visits	8,800	10,500
Cost per Visit	2,400	4,200
Cost for Patients in Sample for Analysis	729,000	1,043,000
Average Cost per Patient for 6 months	8,500	23,000

The average cost per patient in Rwimi is 2.7 times lower than the cost in JCRC. The main cost driver for the staff cost at JCRC is the doctors salary which accounts up to 68.0% of all staff cost. The reason why the program at Rwimi was implemented in the first place was because hiring very scarce doctor resources for HAART treatment is very difficult and also very costly. The Rwimi cohort staff costs show that there is considerable savings on clinical staff cost at the level of the public health sector that can be made if lower skilled staff is used for the HAART program instead of higher skilled doctors without being detrimental to the health of patients as it has been shown that both programs have comparable outcomes (Alibhai *et al.*, 2008).

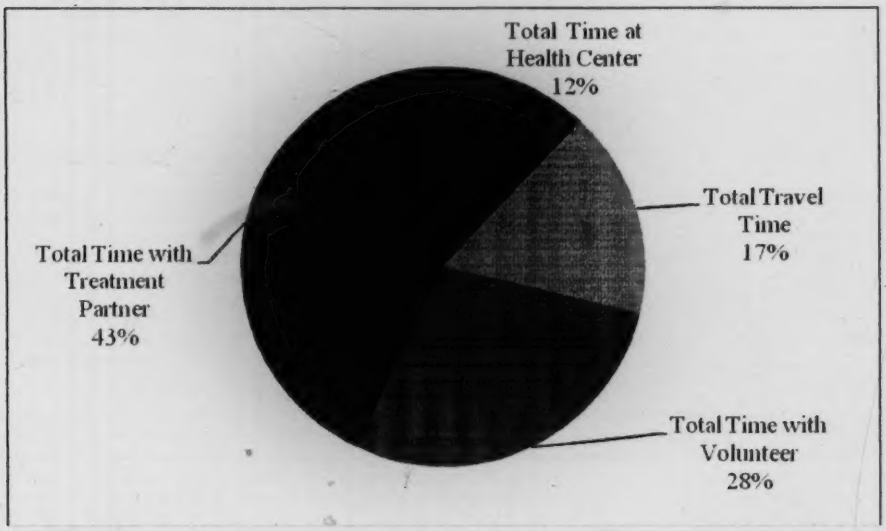
It must be noted that even though the cost of staff at JCRC was higher than at Rwimi, it is known that the costs of staff have likely been underestimated at JCRC as it has been communicated to the author in the past that the clinical officer at JCRC receives a salary from the Ministry of Health and a top-up from the TREAT program (E.Tabusibwa, July 27th, 2006). However, information was not available on whether all the staff at the JCRC clinic was employed at the JCRC clinic throughout the time of our evaluation.

5.2.5 Patients' Time Cost

The patients' time cost is another cost component common to both costing models. The costs have been calculated differently because of the different information that was available. In the Rwimi cohort, there were 14 missing cases for the distance the patient travels to the clinic (one-way). The average distance traveled by the patients for whom the data was available was used to replace the missing values. For the Rwimi cohort, the total time that the patient spent on the program consists of time spent attending scheduled and unscheduled visits, traveling and time with treatment partners and volunteers.

Figure 13 shows the division of the total time spent on the program by the patient among the different activities. It also shows that the total care time at the Rwimi Health Center for the 86 patients for 6 months amounted to only 12% of the total time the patient spent on the program.

Figure 13 Pie Chart Showing the Division of the Total Time the Patients Spent on the Program *(n=86 for 6 Months)*



It is reasonable to assume that the patients will access most of their health care needs at the Rwimi Health Center because the patients will likely report their ailments to the volunteer who will in turn refer them to the Rwimi Health Center. This implies that the burden on the health system in general is relatively low. The pie chart shows that travel time is also among the lowest percentages of the total time spent on the program. This is because the patients in the Rwimi Cohort lived on average less than 5 kilometers from the Rwimi Health Center. This suggests that the community-based program is beneficial in terms of both geographical and financial accessibility. The finding on the travel time in this respect corroborates the findings in Chapter 4 that suggested the community-based program has several benefits related to accessibility.

The two biggest portions of time spent on the project included activities with treatment partners (43%) and volunteers (28%). The time spent with the treatment partner refers only to care time does not consider socialization time. Table 39 shows that the cost of time for the 86 patients for 6 months is 495,000 USh. The average cost per patient for 6 months is 5,800 USh.

Table 39 Cost Per Patient for 6 Months- Rwimi Cohort

Total Time and Total Costs for Patients for 6 Months	
Items	***Time Used by Patients on Project***
Total Number of Patients	86
Total Time for 86 Patients in Hours	3,000
Average Total Time per Patient in Hours	35
Items	***Costs of Time of Patients* (2007 USh)**
Cost per Hour (USh)	163
Total Cost for 86 Patients (USh)	495,000
Average Cost per Patient (USh)	5,800

Table 40 shows that the mean and median number of medical visits is 3.6 and 3.0 respectively.

Table 40 Statistics on the Different Categories of the Time the Patients Spent on the Project- Rwimi Cohort

Total Time and Total Costs for Patients for 6 Months				
Variables	***Median***	***Mean***	***Standard Deviation***	***(Lower Quartile, Upper Quartile)***
Total number of visits	3	3.6	1.032	(3.0,4.0)
Total time (Hours)	35.1	35.4	5.3	(32.1,37.9)
Total Costs per Patient (USh)	5,700	5,800	854	(5,200, 6,100)

This suggests that the patients on average stick to the scheduled visits only, which implies that there are few visits for opportunistic infections treatment. (In fact, 64% had only 3 visits- being the scheduled visits).

Table 41 shows the calculations for the patients' time in the JCRC cohort.

Table 41 Cost per Patient for 6 Months- JCRC cohort

Total Time and Total Costs for Patients for 6 Months	
Items	***Time Used by Patients on Project***
Total Number of Patients[2]	46
Total Time for 46 Patients in Hours	1,200
Average Total Time per Patient in Hours	26.7
Items	***Costs of Time of Patients***
	2007 USh
Cost per Hour	352
Total Cost for 46 Patients	433,000
Average Cost per Patient	9,400

The average cost per patient in JCRC is 9,400 USh. Table 42 below shows some statistics on the patient's activities related to the treatment.

[2] For the JCRC cohort there were two missing cases and one data entry error for the amount of time spent on traveling and care at the clinic. They were replaced by the average time obtained from the data available for other patients.

Table 42 Statistics on Patients' Time JCRC cohort

Total Time and Total Costs for One Patient for 6 Months				
Variables	***Median***	***Mean***	***Standard Deviation***	***(Lower Quartile, Upper Quartile)***
Total Number of Visits	5.50	5.43	1.42	(4.00, 6.00)
Total Time (Hours)	26.5	26.7	14.0	(15.1,35.0)
Total Costs (USh)	9,300	9,400	4,900	(5,300,12,000)

The mean number of visits is 5.4 as shown in Table 42. The number of visits should have been 7 for each patient: the lead-in dose visits and 6 monthly visits. However, there are different reasons that may explain why the 7 visits are not observed. The first being that the patients may have come to refill their prescriptions and did not see a doctor. Therefore, this visit to the clinic was not noted in the patient's file. Second, it is also possible that the visit was simply not recorded. Another explanation is that the patients living far from the clinic did not have the financial means to travel to the clinic for the monthly visits. If patients are coming to less visits than they should, then this might pose a problem for adherence and development of resistance to drugs, which can drive the switch to more costly drugs.

The number of medical visits for the Rwimi cohort is lower than for the JCRC cohort (p=0.000). Despite the fact that there were more activities related to the treatment in the CB-DAART at Rwimi (Activities with treatment partners for example), the patient time

for the Rwimi cohorts (35.4 hr per patient) were not excessively greater than for the JCRC cohort (26.7 hr per patient).

5.2.6 Treatment Partner Cost

The treatment partner cost is a cost component unique to the Rwimi cohort. The care time (here referring to time treatment partners spend on their activities related to their position) was assumed to be 5 minutes per day. Table 46 shows the calculation for the cost of the treatment partner. Treatment partners that are household members require 915 minutes (15.25 hours) in 6 months to accomplish their duties and those that are not household members and thus travel to see their patients require 9,300 minutes (155 hours). The typical time for the treatment partner for 6 months for treatment partner activities is increased by ten times (915 minutes as opposed to 9,300 minutes) when the treatment partner has to travel.

In Table 43, in the second row the first portion of the equation refers to the cost of time of treatment partners that are household members whereas the second portion refers to non-household members treatment partners. The average travel time of 22.88 minutes (per trip) was obtained from a sample of 26 non-household member treatment partners in a survey. This results in a weighted average of the time use of household and non-household treatment partners of 62.83 hours.The cost for the treatment partners' time has been evaluated at the same rate as the cost of the volunteers which is 163 USh per hour.

Table 43 Cost per Patient of Treatment Partners' Time for 6 Months

Time Category	
Time per Patient- Weighted Average (Minutes)	3,800
Total Time for 86 Patients (Hours)	5,400
Cost per Hour (USh)	163
Cost per Patient (USh)	10,200

The average cost per patient over 6 months is 10,200 USh.

Further research by other collaborators on the project showed that the turn-over of treatment partners on the project was very high, as high as 40%. It is possible that the treatment partners that travel long distance to take care of the patients stopped to perform this function and are replaced by treatment partners that live closer to the patients. It is therefore important to follow-up on this cost driver that is the traveling time for treatment partners both for costing purposes and for medical purposes . These results suggest that it is preferable that the treatment partner live with or very near the patients. A sensitivity analysis will be conducted to show the impact of all treatment partners being household members (no traveling) in Section 5.4.

5.2.7 Volunteer Costs

The volunteer time costs belong only to the costing model of the Rwimi cohort. The volunteers are involved in monitoring patients' adherence as well as their well-being. They are in fact a substitute for medical staff who would usually perform the follow-up tasks. The volunteer time consists of time spent on duties related to patients and of training time

The data concerning the travel and care time of the volunteers had to be cleaned up for missing data. Table 44 illustrates the causes of missing data and how they were treated.

Table 44 Data Clean Up

Total Cases	3628	
Missing Start or End Time or Both for Visits	293	Complete Cases
Entry Errors	105	Complete Cases
Greater Than Two hours or Equal to Zero	88	Left out
Total Cases (Visits) Used In Analysis	3142	Analyzed

It was also assumed that a visit could not be more than two hours. Any visit that lasted more than 2 hours was removed from the data set. It was later confirmed by the volunteer administrator that the 2 hours consisted of waiting for the patient and of socialization time (Personal Communication, P.Rwakilembe, May 26, 2007). Although, it would be

fair to include those two hours to account for the waiting time, it is very hard to demarcate the waiting time from the socialization time. Therefore, this is considered as a data entry error and the time greater than 2 hours are eliminated from the data set.

The total time the volunteer spent on the patient was divided between the care (time spent on volunteer related activities for the care of the patient) and the travel time. The time for care amounted to 17%, while the travel time amounted to 83%. The data suggests that traveling time, which imposes a cost, can become problematic in the future. The average cost per patient is 11,000 USh as shown in Table 45 below.

Table 45 Cost of Time Per Patient for 6 Months

Total Time and Total Costs for Volunteers for 6 Months	
Items	***Time Used by Patients on Project***
Total Number of Patients	86
Total Time for 86 Patients in Hours	5,800
Average Total Time per Patient in Hours	67
Items	***Costs of Time of Patients (USh)***
Cost per Hour	162
Total Cost for 86 Patients	936,000
Average Cost per Patient	11,000

Table 46 shows some statistics on time and costs of volunteers. The mean time for care and travel shows that on average the volunteer spent approximately 5 times more on

traveling than on activities pertaining to patient care. This reinforces the argument that the location of volunteers near the patients is crucial.

Table 46 Statistics, Total Time and Total costs

Total Time and Total Costs for Volunteers for 6 Months				
Variables	***Median***	***Mean***	***Standard Deviation***	***(Lower Quartile, Upper Quartile)***
Total Time (Hours)	66.80	66.96	18.75	(51.95, 79.07)
Total Care Time(Hours)	9.69	9.94	3.09	(7.64, 11.38)
Total Travel Time(Hours)	47.98	49.02	18.89	(33.42, 61.56)
Total Cost per Patient (USh)	11,000	11,000	3,000	(8,400, 13,000)

A volunteer administrator was also involved in the supervision of the volunteers. The total number of patients used for apportioning the costs of the volunteer administrator for 6 months is 185 (the number of patients in the CB-DAART at Rwimi). The cost of the volunteer administrator therefore reflects low capacity utilization as shown in Table 47. The low capacity utilization is because this project is a pilot one.

Table 47 Cost of Volunteer Administration per Patient for 6 Months

	Total
Volunteer Administrator (USh)	825,000
Cost for a Month (USh)	825,000
Cost for 6 Month(USh)	4,950,000
Cost for 86 Patients for 6 Months (USh)	2,300,000
Cost for 1 Patient for 6 Months (USh)	27,000

The average cost per patient amounted to 27,000USh.

5.2.8 Capital Costs

The only capital outlay that was evaluated for the Rwimi cohort was the cost of the building. There was not much information available and it was necessary to make several assumptions as described in Chapter 3. The main source of data was through personal communication. Table 48 shows the calculations for the Rwimi cohort. The total cost of capital outlays for the Rwimi cohort for 6 months is 288,000 USh. The capital cost per patient is 3,300 USh.

Table 48 Capital Cost per Patient for 6 Months- Rwimi Cohort

Variables	
Original Cost of Rwimi Health Center (USh)	100,000,000
Original Cost of Rwimi Health Center Indexed to 2007 Ugandan Shillings (USh)	331,000,000
Number of Useful Life Years	30 years
Interest Rate	3%
Annuity Factor	20.2
Annual Equivalent Cost (USh)	16,000,000
Cost for 6 Months (USh)	8,000,000
Percentage of Total Visits Attributed to Patients in our Study	3.51%
Cost for 86 Patients for 6 Months (USh)	3.51 x 8,000,000 = 288,000
Cost per Patient (USh)	3,300

Table 49 shows the calculations for the JCRC cohort. As was described in Chapter 3, different type of information and methods were used to reach to the cost of capital outlays in JCRC. The total cost of capital outlays for the JCRC cohort for 6 months is 437,000 USh. The cost per patient is 9,500 USh.

Table 49 Cost per Patient for 6 Months- JCRC Cohort

Capital Outlays	
Variables	
Rental price of a 111.48 m^2 residential building per month	600,000
Area of the JCRC Clinic (m^2)	570
Rental Price for JCRC per Month	3,100,000
Rental price for JCRC for 6 Months	18,400,000
Total Number of Visits at JCRC Clinic in 6 Months	10,495.8
Total Number of Visits for 46 Patients at the JCRC Clinic in 6 Months	250
Percentage of Total Visits Attributed to Patients in our Study	2.38%
Cost for the 46 Patients for 6 Months (250 visits) (USh)	2.38 x 18,400,000 = 437,000
Cost per Patient for 6 Months (USh)	9,500

The total cost of capital outlays per patient is higher for the JCRC cohort than for the Rwimi cohort by 2.8 times. This reflects the fact that the JCRC clinic is found in a prime urban location in the capital town of Fort Portal as opposed to the Rwimi clinic, which is found in the rural areas of Uganda.

5.2.9 Training and Volunteer Administration Cost

The training cost is unique to the Rwimi cohort. This initial training of three days is essential for the implementation of the project. While it is true that there were two doctors or sometimes only one present during the HAART clinic days at Rwimi, they were present for quality assurance for the research project and also for ethical reasons (Personal Communication, A.Alibhai, June 9, 2008) and are therefore considered here to be costs associated with the research project and not the intervention itself. It is possible that they were also performing on the job training however the time spent between research driven activities and program driven activities is not known and not included in our analysis. Therefore, the only cost associated with doctors is the cost of conducting training. Table 50 below shows that the training cost apportioned to 86 patients was 139,000 USh. The average cost of training amounted to 1620 USh per patient. Clearly, if the capacity utilization at Rwimi was higher, the cost per patient would be lower. However, the capacity utilization was limited to the pilot project at Rwimi.

Table 50 Training Costs - Rwimi Cohort

Cost for 86 Patients (185 Patients in Total on the Project)	139,000
Cost per Patient	1,620

In the future, the training for clinical officers would be provided by the Ugandan AIDs Commission for two weeks (Personal Communication, A.Alibhai, June 9, 2008). It is

also essential that the training of new clinical staff at the nursing schools in Uganda involves HAART program management in the curriculum so that there is a critical mass of trained health care personnel in Uganda. The cost of providing the training at the nursing schools will be much lower compared to the costs of providing training to clinical officers and nurses already integrated in the workforce and scattered over the country. The cost per patient for the administrative meetings with volunteers is 4,430 USh which brings the total spent under the item training and volunteer administration cost to 6050 USh.

5.3 Cost Consequences Analysis

The CCA of the intervention is presented below. For the sake of a detailed analysis, the costs components of both costing models were grouped into three categories. The costs with a public health care program perspective in this thesis included ARV and non-ARV drugs costs, medical staff and capital costs for both Rwimi and JCRC only. In addition, training and volunteer administrator costs were included for Rwimi cohort only. The indirect costs for both cohorts included the opportunity cost of time of the patients whereas for Rwimi this cost category also included opportunity cost of time of volunteers and treatment partners. The cost from a societal perspective was simply the sum of the two aforementioned cost categories.

Q-Q plots of the three types of cost categories denoted very severe deviation from normality. Therefore, as suggested by Drummond *et al.* (2005), the data were transformed using log and square root transformations in an attempt to remedy the

situation but to no avail. The distributions were still skewed. Non-parametric tests have also been recommended and are shown in Table 52. However, remedies to skewed costs data have all been criticized and there are many uncertainties around these methods. Drummond *et al.* (2005) therefore recommended:

> "Given these methodological uncertainties, the analyst would be well advised to present as much detail about the cost distribution as possible." *(pg 255)*

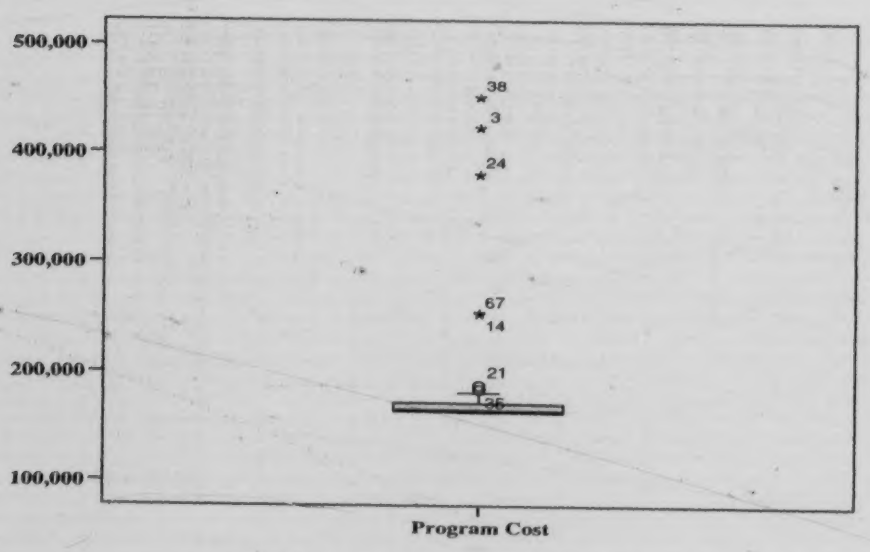
Table 51 below presents detailed information on the cost distributions in response to the above recommendation from Drummond *et al.* (2005). Figure 14 shows the box plots of the costs in the two cohorts.

Table 51 Statistics for Costs per Patient- Rwimi and JCRC Cohorts

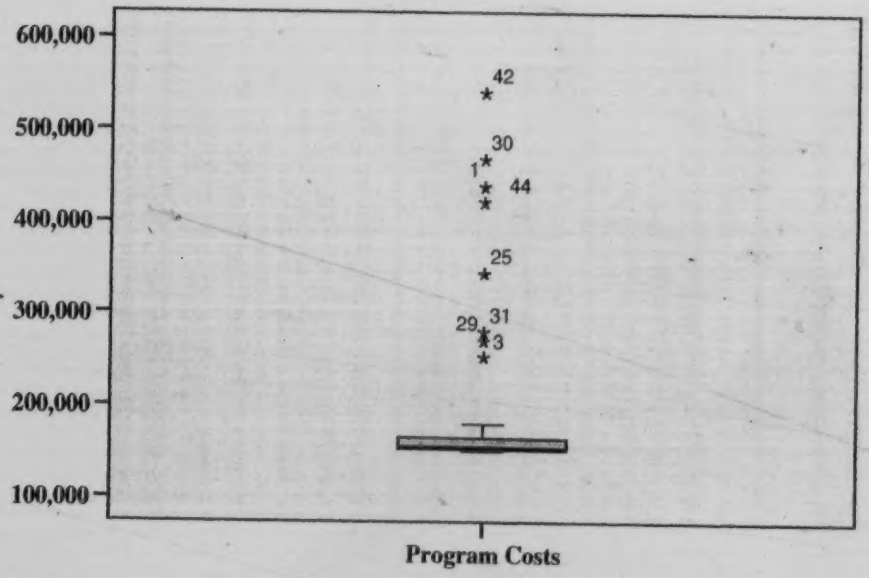
Types of Costs	Rwimi			JCRC		
	Mean (USh)	Median (USh)	IQR* (USh)	Mean (USh)	Median (USh)	IQR* (USh)
Cost: Public Health Care Program Perspective	179,000	166,000	7,800	195,000	154,000	15,000
Cost: Indirect	27,000	26,000	5,300	9,400	9,300	7,000
Cost: Societal Perspective	205,000	193,000	9,900	204,000	167,000	17,000

Note: IQR- Interquartile Range

Figure 14 Cost Distributions of Individuals Infected with HIV/AIDS by Cost Categories for the Program Costs- (a), (b) Indirect Costs- (c), (d) and Societal Costs (e), (f)

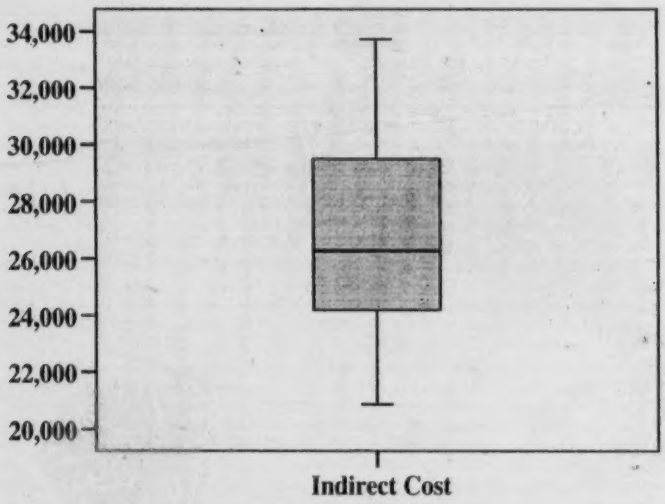


(a) Program Costs (USh) in Rwimi

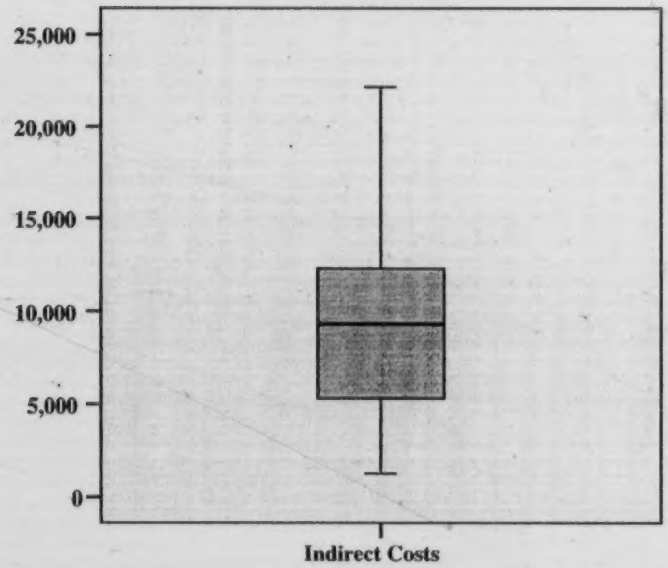


(b) Program Costs (USh) at JCRC

Figure 14 Cost Distributions of Individuals Infected with HIV/AIDS by Cost Categories for the Program Costs- (a), (b) Indirect Costs- (c), (d) and Societal Costs (e), (f) (*Continued*)

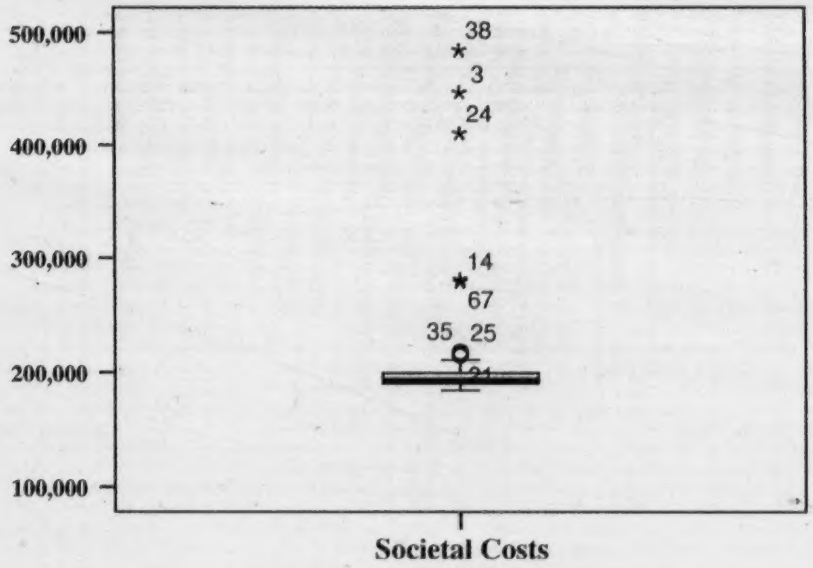


(c) Indirect Costs (USh) in Rwimi

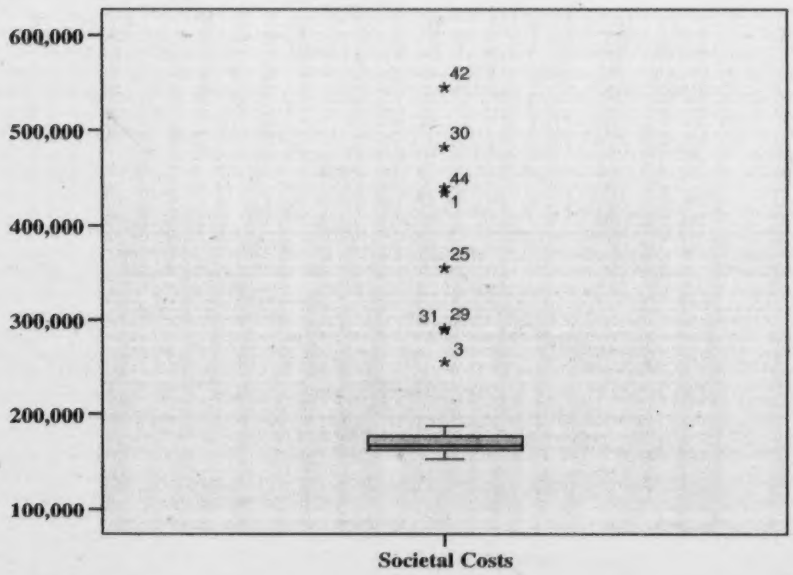


(d) Indirect Costs (USh) at JCRC

Figure 14 Cost Distributions of Individuals Infected with HIV/AIDS by Cost Categories for the Program Costs- (a), (b) Indirect Costs- (c), (d) and Societal Costs (e), (f) (*Continued*)



(e) Societal Costs (USh) in Rwimi



(f) Societal Costs (USh) at JCRC

Given that it is known that the distributions are skewed, the means are also skewed in the direction of the tails. However, it is important that the means be presented as they are more appropriate than medians for policy-makers (Drummond *et al.*, 2005). Moreover, Davis and Mukamal (2006) also brings an interesting view on why the means of skewed costs distributions should be presented:

> (...) for some measurements, we may want the center to reflect the pull of extreme values. For example, when measuring health care costs, we may want the "average" expenditure to reflect the almost inevitable presence of a few subjects with very high costs. In such a case, the mean multiplied by the sample size recreates the total expenditure in the sample, but the median does not.

Extremes are important in health care costs as they can drive the budget up and make the whole program inaccessible for the people. In Table 51, the effect of extremes can be seen for both the JCRC and Rwimi cohorts. The JCRC cohort has the highest individual patient total costs of 545,000 USh and 540,000 USh for societal and program costs respectively whereas for Rwimi the highest costs were at 451,000 USh and 484,000 USh for the same categories. These extremes pull the mean more to the right for the JCRC cohort than for the Rwimi cohort. The JCRC cohort had also a higher number of outliers than Rwimi. It is important to study the extreme cases and two-stage regression models have been recommended (Drummond *et al.*, 2005). The IQR (inter quartile range) shows that the JCRC cohorts' program and societal costs distributions have greater variability than the Rwimi cohort's distributions for the same categories of costs. This is consistent with the presence of outliers and extreme cases.

As both the mean and the median are important, the first one to show the effect of extreme cases (practical reasons) and the second one to show typical cases (statistical reasons), they are both going to be presented in the CCA analysis in Table 52 below. Recall that a CCA format strives to present a maximum amount of information so that the policy-makers can take from the analysis what is more appropriate for them. The base case scenario is the cost of both HAART delivery models from a societal perspective.

Table 52 Cost Consequences Analysis- 6-Month Evaluation

Cohorts	Rwimi (n=86)	JCRC(n=46)	
Costs (USh)			**p-value**
Drugs- ARVS	10,500,000	6,700,000	
Drugs- Opportunistic Infections	1,001,000	753,000	
Doctor's Time	0.00	715,000	
Clinical Staff Time	729,000	329,000	
Volunteer Administrator Time	2,301,000	0.00	
Training Costs	521,000	0.00	
Capital Outlays	288,000	437,000	
Sub-Total: Program Costs	**15,400,000**	**8,950,000**	
Patient Time	495,000	433,000	
Treatment Partner Time	879,000	0.00	
Volunteer Time	936,000	0.00	
Sub-Total: Indirect Costs	**2,310,000**	**433,000**	
Total: Societal Costs- Base Case	**17,700,000**	**9,400,000**	
Analysis of Effect of Extreme Cases			
Average Program cost	**179,000**	**195,000**	
Average Indirect Cost	**27,000**	**9,400**	
Average Cost per Patient-Base Case	**205,000**	**204,000**	
Analysis of Effect of Typical Cases			
Median Program Cost	166,000	154,000	p=0.000
Median Indirect Cost	26,000	9,300	p=0.000
Median Societal Cost- Base Case	193,000	167,000	p=0.000

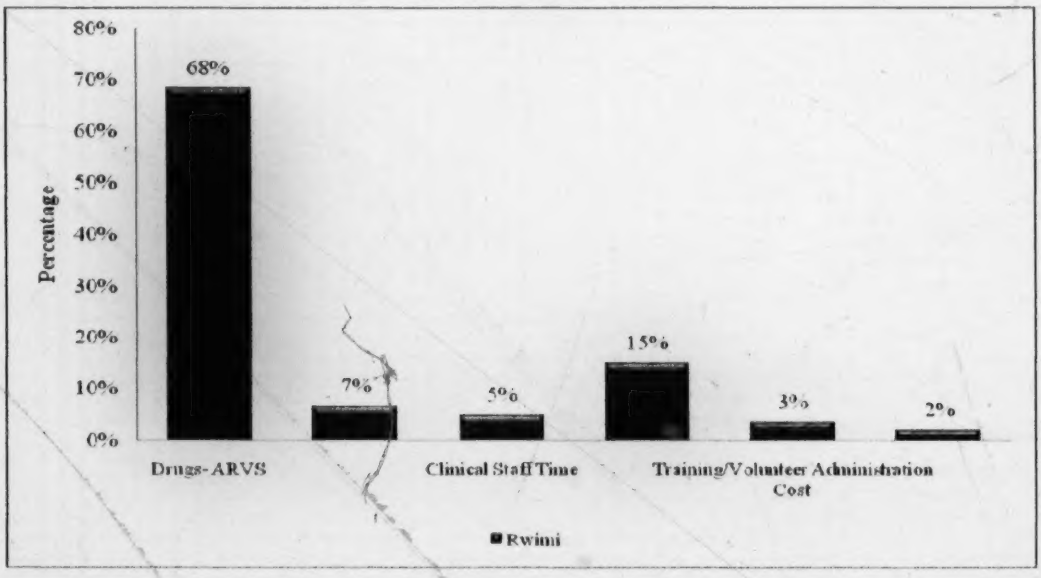
Table 52 Cost Consequences Analysis- 6-Month Evaluation (*Continued*)

Benefits			
	Rwimi	**JCRC**	***p*-value**
Virological Success Rates (Alibhai *et al.*, 2008)	No Difference		
Mortality Rates (Alibhai *et al.*, 2008)	No Difference		
Geographical Accessibility (Km)	4.0	8.0	$p= 0.000$
Number of Visits to Health Center (median)	3.0	5.5	$p= 0.000$

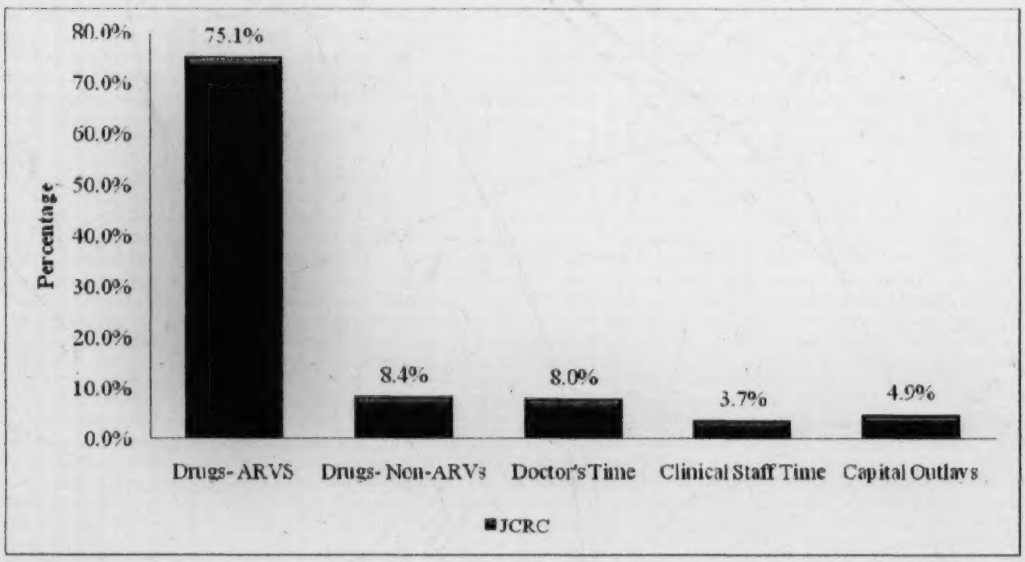
From Table 52, it can be seen that the mean for the program costs is lower for Rwimi than for the JCRC cohort. However, when the effect of extremes is eliminated, the program costs for JCRC is lower (p=0.000). In the case of the indirect costs, the mean and the median is higher for the Rwimi cohort (p=0.000). One very important observation is that the average indirect cost per patient in Rwimi is 2.9 times higher than the average indirect cost in JCRC. Therefore, it is important to control costs associated with the items under the indirect costs for Rwimi. It is important to note that for the base case, the mean and the median show that the cost is higher for the Rwimi cohort than for the JCRC cohort (p=0.000).

Figures 14 (a) and (b) below shows that the ARV drugs are by far the main cost drivers in the program costs of both cohort (68% for Rwimi and 75.1% for JCRC). This corroborates other findings by Cleary *et al.* (2005) who performed an evaluation of HAART treatment in South Africa and found that ARV drugs were the major cost driver.

Figure 15 Bar Charts Showing the Split of the Program Costs at Rwimi (a) and JCRC (b)



(a)

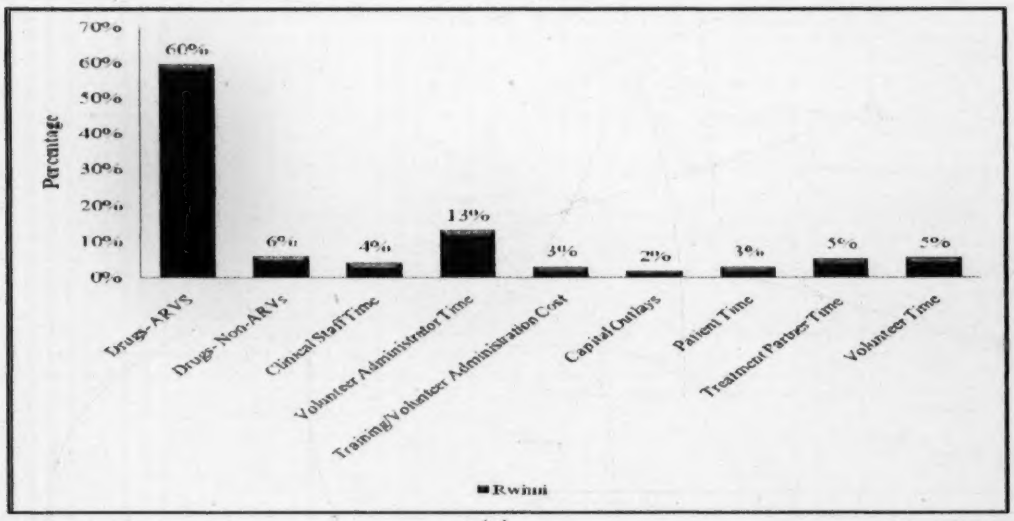


(b)

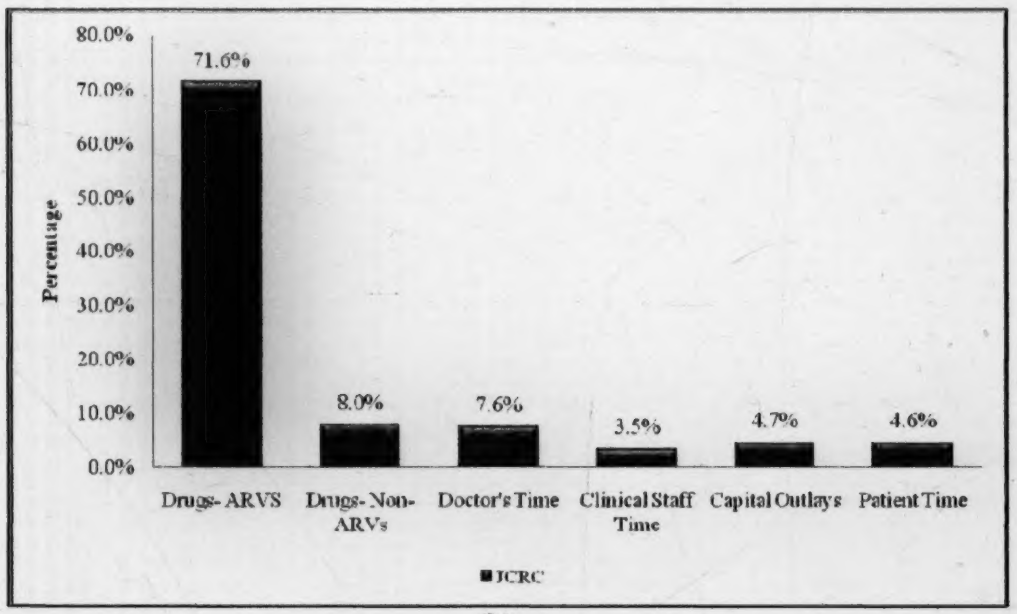
The second cost driver in Rwimi is the volunteer administrator cost (15% of all program cost). It is expected that as the number of patient increases, the cost per patient will decrease considerably for this cost driver. In the JCRC cohort, the second cost driver is the non-ARV drugs at 8.4% of all program costs (opportunistics infections and others) followed closely by the cost of the doctors (8.0% of program costs).

Figures 15 (a) and (b) show that from a societal costing perspective, the ARVs drugs are still the main cost drivers. This demonstrates that even when society is willing to provide resources such as treatment partners and volunteers, the greatest financial barrier might still be the cost of the ARV drugs.

Figure 16 Split of the Societal Costs at Rwimi (a) and JCRC (b)



(a)



(b)

The outcomes show that the Rwimi and the JCRC cohort are comparable in terms of viral load decrease and mortality rates (Alibhai *et al.*, 208). However, Rwimi is superior in terms of geographical accessibility, as the median distance to the health center is 4.0 km and for JCRC it is 8.0 km (p=0.000). The number of visits to the respective health center per patient is also lower in the Rwimi cohort compared to the JCRC cohort (p=0.000). Our results are similar to those obtained by Samson *et al.*. (2008) in Los Angeles whereby there was no difference in biological outcomes between a DAART program involving community workers, and a standard of care program. However, there was differential health care utilization level.

The CCA format allows the decision makers to have a better appraisal of all the factors in play when making a decision. No attempt is made to produce an explicit cost effectiveness ratio as the information is presented as objectively as possible.

5.4 Sensitivity Analysis

Several authors (Muennig, 2002 and Drummond *et al.*, 2005) have pointed out that for a meaningful sensitivity analysis, plausible ranges of the variables must be obtained. It was not possible to do an extensive sensitivity analysis because plausible ranges for the various cost components were not available from the literature since the CB-DAART model is rare in developing countries. Expert opinion was also solicited but with no pertinent results. In this thesis, sensitivity analyses are conducted for two reasons: To test

parameters for which there were uncertainties, and to investigate operational and policy issues.

Sensitivity Analyses to Test Parameters for Uncertainty

1. **Number of HIV/AIDS-related Medical Visits of the JCRC Patients:** There was uncertainty arising from the fact that there was no systematic way of collecting data for the visits of patients in the JCRC cohort to health facilities other than JCRC. In the Rwimi cohort, due to the weekly visits of the volunteer, medical visits were likely more traceable. Another reason that fuels the uncertainty around the number of medical visits for the JCRC patients is that usually the number of scheduled visits in 6 months should have been 7. However, the median number of visits was 5.5. It is also possible that patients visited health facilities closer to their home when affected by opportunistic infections due to HIV/AIDS. The plausible point for the number of visits for patients at the JCRC cohorts is seven visits. Therefore, this value is used in a sensitivity analysis. Table 53 shows that the base case scenario is not sensitive to the change to 7 visits.

2. **Time for Volunteers:** The time the volunteer spent with the patients on weekly visits might have been overestimated as the time recorded might include time for socialization. The 25th percentile for the total time for the volunteer was used to test whether this changes the outcome in our base case. The sensitivity analysis shows that the use of the 25th percentile did not affect the base case scenario.

3. **Discount Rate for Rwimi Capital Cost Calculation:** the capital cost at Rwimi is recalculated at discount rate of 0 and 5 % as recommended by Drummond *et al.* (2005). The sensitivity analysis shows that the base case scenario is robust to this change.

4. **A 60-hour work week**: It was assumed that the hours worked per week was 40 hours such that a wage per hour could be calculated. A 60-hour work-week was tested to assess the impact on the base-case and it is shown that there is no impact.

Sensitivity Analyses to Investigate Operational and Policy Issues

1. **Capacity Utilization for Volunteer Administrator Cost:** The volunteer administrator is the second major cost driver in the Rwimi program and it reflects a low capacity utilization as the cost of the volunteer administrator was apportioned over only 185 patients. The project at Rwimi is a pilot project. This sensitivity analysis is performed to test whether a scale-up of the program registers a change in the program cost and the base case scenario. A scenario whereby the volunteer administrator manage volunteers that are involved with patients in health centers other than Rwimi is used to justify the high capacity utilization of 400 patients to reapportion the cost of the volunteer administrator. The capacity utilization of 400 patients has been derived from information from the volunteer administrator (Personal Communication, P.Rwakilembe, July 3, 2008). He explained that a volunteer administrator can manage up to 80

volunteers depending on the stage of the project. In the initial stage 50 volunteers is feasible. Considering that each volunteers can in turn take care of 4-5 patients, 400 patients seem a plausible point to test. This scenario implies scale-up of HIV/AIDS treatment program in more Health Center III facilities. The sensitivity analysis shows that the base case scenario is robust to the increase in capacity utilization. However, the cost from a health care program perspective is lower for Rwimi under these scenarios (p=0.000).

2. **Treatment Partners are Household Members Only:** the impact of having all treatment partners as household members of the patients is investigated to inform operational management (no travel time for the treatment partners). The sensitivity analysis shows that the base case scenario was robust to this variation.

Table 53 Sensitivity Analysis

Cohorts	Rwimi	JCRC	Statistical Difference Between the Two Cohorts (Mann-Whitney Test)	Change from Base Case Scenario
Median Costs (USh)			*p*-value	
Base Case: Societal Cost	193,000	167,000	*p*=0.000	
Base Case: Program Cost Portion Only	166,000	154,000	p=0.000	
JCRC Patients: Seven visits	193,000	170,000	*p*=0.000	Unchanged
Time for Volunteers: 25th Percentile of Total Costs per Patient	190,000	167,000	*p*=0.000	Unchanged
Discount Rate for Rwimi Capital Outlays: - 0 % - 5 %	192,000 194,000	167,000	*p*=0.000 *p*=0.000	Unchanged
Volunteer Administrator : **Societal Cost** - 400 Patients	179,000	167,000	*p*=0.000 *p*=0.000	Unchanged
Volunteer Administrator :**Program Cost** - 400Patients -	151,000	154,000	*p*=0.000 *p*=0.000	Changed
Treatment Partners: Household Members Only	186,000	167,000	*p*=0.000	Unchanged
Assuming a 60 hours work-week	184,000	163,000	*P=0.000*	Unchanged

The sensitivity analyses showed that the base case scenario is robust to changes over plausible ranges for the factors showed in Table 53. The program cost has been mentioned in the case of the volunteer administrator cost because a change in capacity

utilization of the volunteer administrator cost showed that the program cost registers a change in Rwimi in the magnitude of making it less costly than the program cost at JCRC (p=0.000). This shows that there is the potential of decreasing program cost in the CB-DAART program as capacity utilization increases. Table 54 summarizes the average cost per patient in both costing models.

Table 54 Summary of Costs per Patient for the Two Costing Models

	Costing Models	Rwimi Costing Model		JCRC Costing Model	
		2007 Ush	2007 USD*	2007 Ush	2007 USD
1	ARV Drugs	122,000	70.21	146,000	83.99
2	Non-ARV Drugs	12,000	6.68	16,000	9.40
3	Medical Staff	8,500	4.87	23,000	13.03
4	Patient's Time	5,800	3.30	9,400	5.41
5	Capital Cost	3,300	1.92	9,500	5.46
6	Training/Volunteer Administration Cost Cost	6,100	3.48		
7	Treatment Partner	10,000	5.86		
8	Volunteer	11,000	6.25		
9	Volunteer Administrator cost	27,000	15.37		

Source: the exchange rate is 1741.23 USh for $1USD (OANDA Corporation, 2008).

CHAPTER 6

GENERAL DISCUSSION, CONCLUSIONS AND FURTHER RESEARCH

The aim of this thesis was to gather information on the community-based model of delivering HAART to rural patients. Toward this end ,this thesis collected information on: How generalizable the study is; how it compares and contrasts with the comparator; who are the individuals benefiting from the program; potential operational issues; cost drivers; costs; and outcomes descriptions.

6.1 General Discussion and Conclusions

6.1.1 Generalizability and Comparability

Comparing Rwimi to the HIV Sero-Positive Population of Uganda

The two cohorts were compared to the infected population of Uganda. In this section, we summarized the information for Rwimi only as it is the intervention and it is important to know to what extent the results obtained in this intervention is generalizable to the rest of Uganda. Thus, the comparison of the Rwimi cohort to the Ugandan HIV sero-positive population contributes to our understanding of transferability. When it was not possible to compare the characteristics of the participants in the Rwimi cohort to the characteristics of the infected population in Uganda, or when it made sense, the

characteristics of the participants were instead compared to the characteristics of the total population of Uganda. This analysis revealed that:

- The peak age of the participants in the Rwimi cohort corresponds to the Ugandan peak age for sero-positive individuals in Uganda.
- The participation rate by gender composition and marital status does not correspond to the infection rate by gender composition and marital status for the USP. Married women in the Rwimi cohort seemed to have been disadvantaged in access.
- The education data analysis for the Rwimi cohort showed some differences and some similarities to the infection rate by education in Uganda.
- The occupation pattern of the gender-disaggregated data is typical of Uganda.
- There were more people with an occupation than without an occupation in the Rwimi cohort, which is a similar pattern present in the USP.

The intervention involves patients of rural Uganda and the patients seem to share some characteristics with the Ugandan infected population. However, because more precise information was not available on important health determinants such as wealth quintile and standard of living indicators (e.g. housing conditions) and also because of geographical differences in Uganda, further research is needed to ascertain the transferability to all regions of Uganda, both urban and rural.

Comparing Rwimi Cohort to the JCRC Cohort:

Table 55 shows that there were several areas of statistically significant difference between the two cohorts for the characteristics evaluated.

Table 55 Comparisons between the Rwimi and the JCRC Cohorts

Variables	*p*-value
Gender Composition	0.829
Age	0.007
Education	0.826
Distance to Health Center	0.000
Occupation (farming versus non-farming)	0.002

There are statistically significant differences between the two cohorts for age, occupation, and distance traveled to the respective health facility. This might have important implications both in terms of the effectiveness and costs of the two interventions. The JCRC clinic model was an appropriate comparator in the sense that it is one of the largest providers of HAART in Uganda. There are 42 JCRC sites which provide HIV/AIDS care in Uganda. However, the JCRC cohort is in some ways a less than ideal comparator. The services at the JCRC clinic are not universally free. For categories of patients who are not in the eligible groups for free HAART-related services, the services are provided on a cost share basis (Personal Communication,

E.Tabusibwa, 2006). Most patients cannot afford those services or they are too far from where they live. The patients at Rwimi, for example, were not accessing the services at the JCRC clinic despite the fact that the JCRC Regional Center of Excellence is found in Fort Portal in the same district. The alternative, which is available to all Ugandan, is the treatment of opportunistic infection resulting from HIV/AIDS. This is the best comparator to understand the real benefits of providing ART to the rural population. A comparator that could be used to evaluate the costs of different ART programs could be standard ART program in government facilities. There are over 100 such sites in Uganda. Future research could determine whether there were confounding variables affecting the effectiveness and costs results of both the intervention and the comparator.

6.1.2 Potential Operational Issues Uncovered by the Socio-Demographic Analysis and Cost Analysis

1) One potential issue could be difficulty in recruiting married women due to challenges related to cultural accessibility. The issues are with regard to male volunteers making weekly house calls at married women's house. More women volunteers should be involved in the program. A qualitative research approach could be used to first identify whether male volunteers have an impact on women enrolment in and usage of the service should be performed. This qualitative study could then be used to frame a quantitative study to quantify the impact if any was uncovered. It is important to study cultural factors that might have economic impacts.

2) There is high dependency on volunteers and treatment partners. This can pose a problem in the future if the volunteers for example expect to be remunerated. With increased economic development in Uganda, fewer people might be available for volunteering as the opportunity cost of their time increases.

6.1.3 Specific Group Benefitting from the Treatment

The specific groups benefitting from the community-based programs are:

1) Rural residents that either would not have access to HAART services or would have to travel very far to access this type of service. The community-based program contributes to geographical equity in access to HAART services.
2) Care givers who form a majority of the group benefitting from the community-based programs. The participation of this category of patients in the program improves both intra-generational and, inter-generational equity.
3) Individuals who are in the most productive years of their life. The participation of this group can produce important social and economic spill-overs. The patients spent more time with those partners in health care provision that with the clinical staff.

6.1.4 Costs

The cost analysis showed that the main cost drivers for both cohorts are the costs of the ARV drugs. This implies that it is important that the efforts to reduce the cost of ARV drugs continues. The second cost driver in the Rwimi cohort is the volunteer administrator cost (13%) and it reflects in large part the low capacity utilization of the

program at Rwimi as it is a pilot project. The next important drivers in the JCRC cohort after the ARV Drugs are the non-ARV drugs (8.0%) and the doctors' costs (7.6%). The cost per patient of non-ARV drugs and of the medical staff is lower in Rwimi than JCRC. The data showed that the cost distributions in both cohorts were skewed andthe median costs for the base case were higher for Rwimi (193,000 USh per patient) than for JCRC (167,000 USh per patient). The mean was presented because it is important to see the extreme cases effect in the context of health care cost. It was thus shown that the mean for the program cost at Rwimi was lower (179,000 USh per patient) than for the JCRC cohort (195,000 USh per patient) for those two particular samples. The mean societal costs were comparable in both cohorts. The average and median costs of the different types of costs are shown below in Tables 56 and 57.

Table 56 Average Costs in the Rwimi and the JCRC Cohorts

Types of Costs	Rwimi (USh)	JCRC (USh)
Program	**179,000**	**195,000**
Indirect	**27,000**	**9,400**
Societal	**205,000**	**204,000**

Table 57 Median Costs in the Rwimi and the JCRC Cohorts

Types of Costs	Rwimi (USh)	JCRC (USh)
Program	**166,000**	**154,000**
Indirect	**26,000**	**9,300**
Societal	**193,000**	**167,000**

It is important that future research involves the analysis of extreme cases at JCRC. Sensitivity analyses conducted showed that the base case scenario was robust to all the scenarios tested. However, the median program cost was lower for Rwimi when the volunteer administration cost was apportioned in a sensitivity analysis over a higher utilization rate of 400 patients. This shows that there is much room for possible improvement in the program cost if the program scale-ups.

6.1.5 Outcomes

The biological outcomes, virological success (undetectable level of virus at 400 copies per ml of blood) and the mortality rates, were comparable in both cohorts (Alibhai *et al.*, 2008). Another important benefit of the CB-DAART program was that the mean and median numbers of visits were lower for the Rwimi cohort than for the JCRC cohort (p=0.000). This has important implications for the health sector, which will be less burdened by HAART patients' visits because of the CB-DAART model. A further important benefit was that the geographical accessibility of care was achieved in Rwimi as the mean and median distance travelled by patients was less than 5 kilometers as

opposed to the JCRC cohort where the mean and median distances travelled was greater than 5 kilometers. Thus, the CB-DAART program contributes to geographical and financial accessibility to health care. It must be underlined that had it not been for the CB-DAART program the patients in our study would unlikely have had access to HAART. This study demonstrates clearly that scarce doctor resources, which can be an impediment to wide access of HAART, are not necessarily a binding constraint if the community-based approach is considered. However, it is important to be reminded that the study shows the result for the first 6 months only. HIV/AIDS is a chronic disease; it is important that information is continuously gathered on the biological aspects as well as the number of visits.

6.2 Weaknesses, Strengths and Future Research

6.2.1 Weaknesses and Future Research

Our study uses a non-randomized design and therefore there is a possibility that our results were affected by confounding variables. There is also a very vigorous debate in the literature on the validity of the results thus obtained (Benson and Hartz, 2000; Concato *et al.*, 2000; Pocock and Elbourne, 2000). Some authors contend that significance testing should not be performed (Ludwig, 2005). Despite these criticisms, the study is still valuable in that it adds an important amount of knowledge on CB-DAART. Future research could involve the impact of the design on the research results.

There were missing data in the analyses. There were also many instances where data were not available at all for some variables for the valuation exercise. It was also very

hard to obtain plausible ranges of values for parameters for which uncertainty exists in order to perform sensitivity analyses. The parameters for which there was no information available include: transport cost for patients in both cohorts, travel time for the patients at Rwimi, time treatment partner spend with patients, the value of the capital costs at JCRC and the salary of the clinical staff at JCRC. Assumptions were also made on the average number of visits in both cohorts. Several other assumptions had to be made with respect to the CPI in 1989 for the calculation of the capital cost at Rwimi.

Another shortcoming is that this is not a cost benefit analysis, which would ultimately be more relevant for informing policy choice. For example, the benefits associated with providing care to rural patients who otherwise would not have access to care cannot be assessed in the present comparison. A do-nothing comparator where only opportunistic infection management is possible is the situation in most rural Uganda and therefore would have been the best comparator to compare the intervention to understand fully the benefits and costs to society of providing the CB-DAART treatment. The possibility of savings to the public sector in terms of orphanage or other care for orphans of HIV when caregivers experience decreasing mortality rate in the CB-DAART is important but was not considered. There are also benefits associated with decrease burden on health care due to a reduced number of visits (median of 3 visits in the CB-DAART program compared to the 5.5 visits of the JCRC model). The impact of a reduced visit burden on other diseases morbidity has not been fully accounted for.

Finally, the study has data on only 6-month treatment for a life-long treatment and therefore future research will have to address long-term costs and benefits.

6.2.2 Strengths

The study is an early evaluation and therefore is very useful in providing insights for operational management and data collection. The study has identified major data gap for the valuation of both models. The findings in this study can be used to improve the design of future studies.

The study relies on an observational design to investigate an intervention in a real-life setting. Primary costs and effectiveness data are obtained directly from the study itself, and did not need to be extrapolated from other data sources. Future research could involve the use of randomized designs to eliminate the effect of confounding variables if any. However, these researches tend to be expensive and a trade-off has to be made between using scarce resources in producing high quality data versus providing health care to individuals.

This study is one of the rare studies that considers the opportunity costs of time of patients, volunteers, and treatment partners for a CB-DAART in a rural developing country setting.

The CCA is a simple approach but a relevant and very powerful one where the policy-makers can understand and appraise easily what was done, what were the assumptions and what are the results. They also have a clear indication on cost drivers and potential

cultural and operational challenges that can arise from a CB-DAART program. The simplicity of the format of the analysis to provide key messages makes it a very useful tool for policy-makers.

There exists a gap on economic studies of CB-DAART in developing countries in the literature. This thesis provides important information on who benefits from the care, potential challenges in the provision of CB-DAART, the major costs components involved, the costs drivers and the outcomes.

6.3 Conclusions

The CCA format of our study provided detailed information on costs and outcomes of the study objectively in a simple format within the grasp of the policy-makers. The study leaves it to the decision-maker to pick and choose the information of most interest to their purpose. Although, there were several weaknesses to our study, its most important strength is to contribute important information to the literature on the CB-DAART model. This study can be used as a solid reference for future research on CB-DAART models.

The most important conclusion from this thesis is that our analysis suggests that the CB-DAART program is a viable option in Uganda. It has comparable costs and outcomes to the JCRC program. CB-DAART also has advantages over the clinic-based comparator program, such as geographical accessiblity and reduced health care utilization. The CB-DAART is a viable model for expanding health care access in Uganda.

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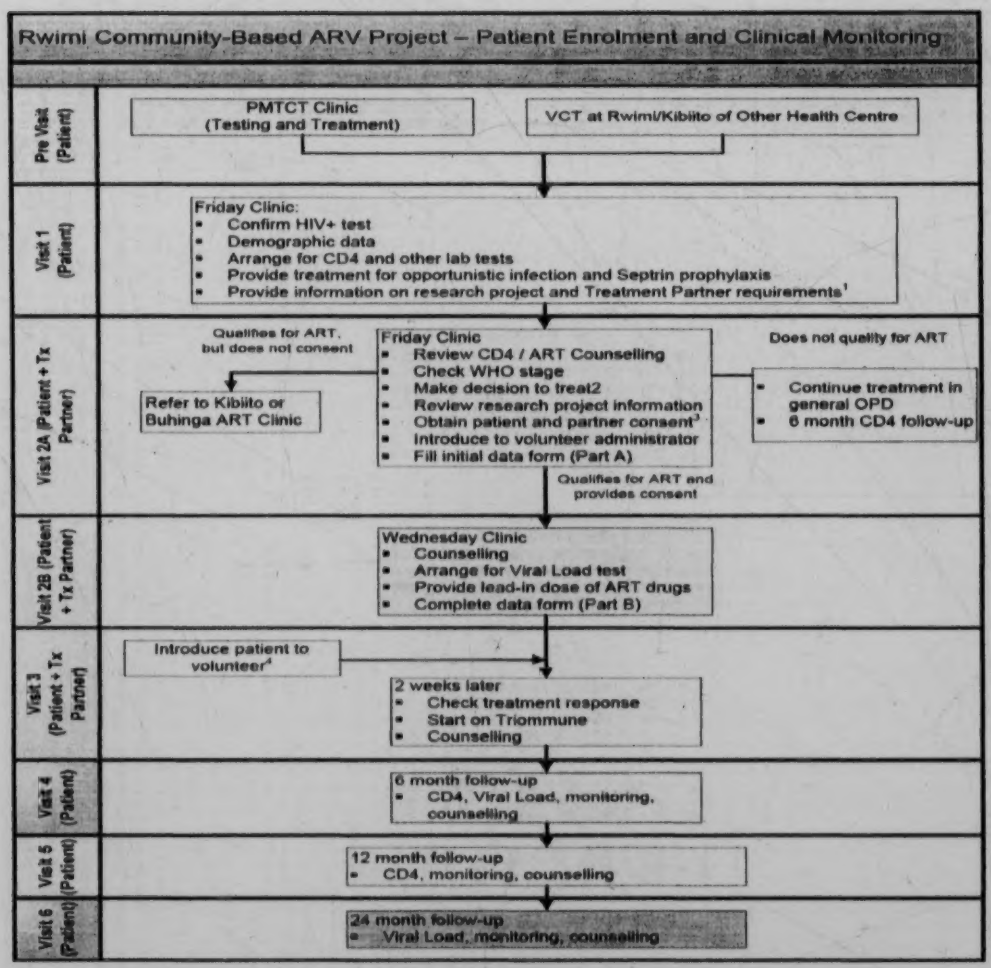
APPENDIX A


Rwimi Community-Based ARV Project – Patient Enrolment and Clinical Monitoring
Pre Visit (Patient)
PMTCT Clinic (Testing and Treatment)
VCT at Rwimi/Kibiito of Other Health Centre
Visit 1 (Patient)
Friday Clinic:
Confirm HIV+ test
Demographic data
Arrange for CD4 and other lab tests
Provide treatment for opportunistic infection and Septrin prophylaxis
Provide information on research project and Treatment Partner requirements[1]
Visit 2A (Patient + Tx Partner)
Qualifies for ART, but does not consent
Refer to Kibiito or Buhinga ART Clinic
Friday Clinic
Review CD4 / ART Counselling
Check WHO stage
Make decision to treat2
Review research project information
Obtain patient and partner consent[3]
Introduce to volunteer administrator
Fill initial data form (Part A)
Does not quality for ART
Continue treatment in general OPD
6 month CD4 follow-up
Qualifies for ART and provides consent
Visit 2B (Patient + Tx Partner)
Wednesday Clinic
Counselling
Arrange for Viral Load test
Provide lead-in dose of ART drugs
Complete data form (Part B)
Visit 3 (Patient + Tx Partner)
Introduce patient to volunteer[4]
2 weeks later
Check treatment response
Start on Triommune
Counselling
Visit 4 (Patient)
6 month follow-up
CD4, Viral Load, monitoring, counselling
Visit 5 (Patient)
12 month follow-up
CD4, monitoring, counselling
Visit 6 (Patient)
24 month follow-up
Viral Load, monitoring, counselling

Notes:
[1] Ensure that patient understands that this is part of a research project and understands role of treatment partner
[2] Will treat based on a) WHO Stage IV, b) WHO Stage III + CD4<350 or c) WHO Stage I or II + CD4<200)
[3] Ensure that patient has consented before contacting volunteer administrator or volunteer
[4] Volunteer can be introduced before visit 3 or at visit 3. Volunteer monitoring begins with Triommune therapy

Version 1 (Feb 16 2006)

Source: Personal Communication, A.Alibhai, December 10, 2007

APPENDIX B

Table 1 Valuation of the Lead-in Dose Regimen

Lead-in Dose Triimmume-30				
	Stadivudine	Lamivudine	Nevirapine	Total (USh)
Quantity per Day	2	2	1	
1 Pack Price	60	60	60	
Price Retail	5500	5500	10000	
1 Unit	91.67	91.67	166.67	
Cost Per day	183.33	183.33	166.67	533.33

Table 2 Valuation of the Full Dose Regimen-T-30

Full Dose Triimmume-30	
Quantity per Day (Units)	2
1 Pack (Units)	60
Price Retail (USh)	19000
1 unit (USh)	316.67
Cost Per day (USh)	633.33

Table 3 Valuation of the Full Dose Regimen-Duovir-N

Full Dose Duovir-N	
Quantity per Day (Units)	2
1 Pack (Units)	60
Price Retail (USh)	40000
1 unit (USh)	666.67
Cost Per day (USh)	1333.33

Table 4 Valuation of the Full Dose Regimen-Duovir/Combivir* and Efavirenz

Lead-in Dose Triummune-30			
	Zidovidune Lamivudine	Efavirenz	Total (Ugandan Shillings)
Quantity per Day	2	1	
1 Pack Price	60	30	
Price Retail	28000	42000	
1 unit	466.67	1400	
Cost Per day	933.33	1400	2333.33

Note: * Duovir is the generic version of Combivir and its price has been used to price any Combivir prescription in the patients' files

Source: Quality Chemical Limited, 2007

APPENDIX C

Table 1 T-30 Regimen for Both Rwimi and JCRC Cohorts

Stage of Treatment	Number of Days	Cost per Day (UShs)	Total Cost (UShs)
Lead-in Dose: T-30	14	533.33	7466.62
Full-Dose : T-30	169	633.33	107032.77
Total	183		114499.39

Table 2 Cost of ARV Drugs for Patient 003 in the Rwimi Cohort

Stage of Treatment	Number of Days	Cost per Day (UShs)	Total Cost (UShs)
Lead-in Dose: T-30	14	533.33	7466.62
Full-Dose: T-30	43	633.33	27233.19
Combivir	98	2333.33	228666.34
Full-Dose: T-30	28	633.33	17733.24
Total	183		281099.39

Table 3 Cost of ARV Drugs for Patient 034 in the Rwimi Cohort

Stage of Treatment	Number of Days	Cost per Day (UShs)	Total Cost (UShs)
Lead-in Dose: T-30	14	533.33	7466.62
Full-Dose: T-30	44	633.33	27866.52
Duovir-Efavirenz	125	2333.33	291666.25
Total	183		326999.39

Table 4 Cost of ARV Drugs for Patient 049 in the Rwimi Cohort

Stage of Treatment	Number of Days	Cost per Day (USh)	Total Cost (USh)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-Efavirenz	169	2333.33	394332.77
Total	183		401799.39

Table 5 Cost of ARV Drugs for Patient 004 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per Day (USh)	Total Cost (USh)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-Efavirenz	169	2333.33	394332.77
Total	183		401799.39

Table 6 Cost of ARV Drugs for Patient 092 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per Day (USh)	Total Cost (USh)
Lead-in Dose: T-30	14	533.33	7466.62
Full Dose: T-30	113	633.33	71566.29
Duovir-Efavirenz	56	2333.33	130666.48
Total	183		209699.39

Table 7 Cost of ARV Drugs for Patient 103 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per Day (US$)	Total Cost (US$)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-N	169	1333.33	225332.77
Total	183		232799.39

Table 8 Cost of ARV Drugs for Patient 104 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per Day (US$)	Total Cost (US$)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-Efavirenz	169	2333.33	394332.77
Total	183		401799.39

Table 9 Cost of ARV Drugs for Patient 107 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per Day (US$)	Total Cost (US$)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-N	169	1333.33	225332.77
Total	183		232799.39

Table 10 Cost of ARV Drugs for Patient 158 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per day* (USD)	Cost per Stage (USD)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-Efavirenz	169	2333.33	394332.77
Total	183		401799.39

Table 11 Cost of ARV drugs for Patient 164 in the JCRC Cohort

Stage of Treatment	Number of Days	Cost per day** (USD)	Cost per Stage (USD)
Lead-in Dose: T-30	14	533.33	7466.62
Duovir-Efavirenz	140	2333.33	326666.2
Duovir-N	29	1333.33	38666.57
Total	183		372799.39

- ***Source: A.Clare, Personal Communication, August 4, 2006***
- ****Source: Quality Chemical Limited, 2007***

APPENDIX D

Specific Valuation of Non-ART Drugs

Drugs	Other Names	Base Unit (Tablets or Tube)	*Prices (USh)	Unit Prices (2007 USh)
Acyclovir		100	24,301	243.01
Albendazole		500	24013	48.026
Amoxil	Amoxilin	1000	26667	26.667
Ampiclox	Ampicillin	1	231	231
Amytriptyline		1000	12879	12.879
carbamazepine		1000	38332	38.332
Calamine lotion		100 ml	909	909
Captopril		100	6210	62.1
Ceftriaxone		1	6784	6784
Cetrizine (10 mg)		100	5021	50.21
Ciprofloxacin	ciproflaxin	100	6585	65.85
Clavil	Amoxyclov- Amoxylin 250/clavulanic acid 125	20	19051	952.55
Coartem*	Artemether 20mg + Lumefantine 120 mg	720	131040	
Cold Cap	Chlorphenamine maleate	1000	1282	1.282
Clotrimazole		20mg	540	540
Cotrimoxazole		1000	11838	11.838
Diclofenac		100	909	9.09
Doxycycline		1000	27000	27
EH	Ethambutol/Isoniazid			
Erythromycin		1000	59701	59.701
Flagyl	Metromdazole Metronidazole	1000	5061	5.061
Fluconazole (200 mg)	Diflucan	20	5950	297.5
Gentamycin		1 unit- 80 mg	102	102
Griseofulvin		100	8548	85.48
Ibuprofen		1000	5716	5.716

Specific Valuation of Non-ART Drugs (Continued)

Drug	Other Name	Base Unit	Price (US$)	Unit Price (2007 US$)
Iron sulphate/folic acid		1000	8381	8.381
Ketoconazole		100	10206	102.06
Magnesium Trisilllicate		1000	3460	3.46
Mebendazole		1000	4894	4.894
Multivitamin		1000	4671	4.671
Neurobin		1000	2665	2.665
Nystatin		100	4590	45.9
Paracetamol		1000	4424	4.424
Phenergan		1000	10260	10.26
promethazine		1000	10260	10.26
Pyridoxine		1000	12205	12.205
Quinine		1000	43627	43.627
Tetracycline		3.5 g	334	334
Vitamin A		1000	59248	59.248
Vitamin B complex		1000	2665	2.665

Source: A.Gwaita, Personal Communication, 2007
****NMS (2007) and JMS (2007)***

APPENDIX E

Valuation of Anti-TB Prescription

RHEZ Course (2 months)						
Components	**Pills of:**	**Number of Tablets in 1 Pack**	**Cost of 1 Pack (USh)**	**Unit Price of 1 Tablet (USh)**	**Tablets per day***	**Total Cost (USh)**
Rifampicin /Isoniazide	150mg/100mg	100	13750.00	137.50	3	24,750.00
Ethambutol	400 mg	1000	66000.00	66.00	2	7,920.00
Pyrazinamide	500 mg	100	13750	137.50	3	24,750.00
						57,420.00
EH Course (6 months)						
Isoniazid	300 mg	1000	18700.00	18.70	1	3,422.10
Ethambutol	400 mg	1000	66000.00	66.00	2	24,156.00
						27578.10

Source: The number of tablets per day was calculated from a clinical officer at JCRC (Personal Communication, Aggrey Gwaita, April 16, 2008) and JMS (2007)

APPENDIX F

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs

Patient Number	Drug	Prescription	Number of days	Total quantity	Unit cost	Total cost
001	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				1	Total	5453.75
002	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Paracetamol	2 tablets 3 times a day	3	18	4.424	79.632
	Amoxyl	2 tablets 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	InjectionPPF-Penicilin phosphite			1	357	357.00
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Ventolin			2	Total	7490.40
003	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Panadol	2 3 times a day	3	18	4.424	79.63
	Ciproflaxin	1 two times a day	5	10	65.85	658.52
	RHEZ/EH					84,998.10
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Vitamin B Complex	2 3 times a day	5-7days	42	2.665	111.93
	EH	Continued from above				
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Missing InjectionPFf-penicilin phosphite			1	3914.11	3914.11
	EH	Continued from above				357.00
				3	Total	97,173.04

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patients Number	Type	Prescription	Number of days	Total quantity	Cost per unit (US$)	Total cost (US$)
004	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.708
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.9
	Clotrimazole	1 tube	1	1	540	540.00
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	B complex	2 tablets 3 times a day	5-7days	42	2.665	111.93
	Panadol	2 tablets 3 times a day	3	18	4.424	79.63
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				4	**Total**	6578.70
005	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Phernergan	25 mg 3 times a day	5 days	15	10.26	153.90
				5	**Total**	6407.66
008	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Panadol	2 3 times a day	3	18	4.424	79.63
	Flagyl	2 3 times a day	5	30	5.061	151.83
				8	**Total**	4564.17
009	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			2	3914.11	7828.22
	Multivitamins	2 tablets twice a day	30	120	4.671	560.52
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
				9	**Total**	12,875.35
012	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
				12	**Total**	4486.61
013	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Dapsone					
	Paracetamol					79.63
	Vitamin B Complex					111.93
	Missing			1		3914.11
	Multivitamins	2 tablets twice a day	30	120	4.671	560.52
				13	**Total**	8998.90

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit (USh)	Total cost (USh)
014	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				14	**Total**	4893.23
015	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				15	**Total**	5132.72
016	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Iron sulphate/ folic acid	2 3 times a day	14	84	8.381	704.00
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Coartem					4368.00
	Missing			2	3914.11	7828.22
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
				16	**Total**	17,999.23
0017	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				17	**Total**	4332.71
0018	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Acyclovir	200mg 5 times a day	7	35	243.01	8505.35
	Missing			3	3914.11	11,742.33
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	B.complex	2 3 times a day	5-7days	42	2.665	111.93
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Ceftriazone	2 vials everyday	5	10	6784	67840.00
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				18	**Total**	94,932.35

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total Cost (US$)
0019	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			4	3914.11	15656.44
	Amoxylin	2 3 times a day	5	30	26.667	800.01
	Nystatin	1 od	14	14	45.9	642.60
	Nystatin	1 od	14	14	45.9	642.60
	Propanolol	2 times daily	30	60	4.363	261.78
	Propanolol	2 times daily	30	60	4.363	261.78
				19	**Total**	22,597.92
0020	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
				20	**Total**	8246.82
0021	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				21	**Total**	4893.23
0024	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				24	**Total**	8807.34
0026	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Paracetamol					79.63
	Multi vitamin	2 tablets twice a day	30	120	4.671	560.52
				26	**Total**	4972.86
0027	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multi vitamin	2 tablets twice a day	30	120	4.671	560.52
				27	**Total**	4893.23

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Unit price in US$	Total Cost
0028	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin Vaginal pessaries	1 od	14	14	45.9	642.60
	Missing			3	3914.11	11,742.33
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Metronidazole	2 3 times a day	5	30	5.061	151.83
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Panadol	2 3 times a day	3	18	4.424	79.63
	Fluconazole	200mg od	30 days	30	297.5	8925.00
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
	Clotrimazole	1 tube	1	1	540	540.00
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
				28	**Total**	28,935.23
0030	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Doxycycline	2 times for 7 days	7	14	27	378.00
	Nystatin pessaries	1 od	14	14	45.9	642.60
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Amitryptiline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Acyclovir	200mg 5 times a day	7	35	243.01	8505.35
				30	**Total**	14346.76
0032	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				32	**Total**	4332.71
0034	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				34	**Total**	8472.77

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total Cost
0035	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Missing			4	3914.11	15,656.44
	Doxycycline	2 times for 7 days	7	14	27	378.00
	Benzathine Amoxyl	2 3 times a day	5	30	26.667	800.01
	Nystatin	1 od	14	14	45.9	642.60
				35	**Total**	22,117.56
0037	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
				37	**Total**	8246.82
0038	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Missing			1	3914.11	3914.11
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Captopril	1 twice a day	14 days	28	62.1	1738.80
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				38	**Total**	12706.68
0039	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				39	**Total**	4332.71
0040	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				40	**Total**	5535.83
0041	Cotrimoxazole	2 tablets a day	183	**366**	**11.838**	4332.71
				41	**Total**	4332.71

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total cost
0042	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Metromdazole	2 3 times a day	5	30	5.061	151.83
				42	**Total**	5143.04
0043	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				43	**Total**	4332.71
0044	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				44	**Total**	5132.72
0045	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Quinine					1832.33
	Missing			1	3914.11	3914.11
				45	**Total**	10,079.15
0046	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			5	3914.11	19570.55
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				46	**Total**	25503.28
0047	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Missing			4	3914.11	15656.44
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Vitamin B complex	2 3 times a day	5-7days	42	2.665	111.93
				47	**Total**	21,054.99
0048	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Missing			1	3914.11	3914.11
	Nystatin	1 od	14	14	45.9	642.60
				48	**Total**	9449.94

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Unit cost	Total cost
0049	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				49	**Total**	4332.71
0050	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Missing			1	3914.11	3914.11
	Nystatin	1 od	14	14	45.9	642.60
				50	**Total**	10092.54
0052	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				52	**Total**	4332.71
0053	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				53	**Total**	4893.23
0054	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				54	**Total**	4893.23
0055	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				55	**Total**	4893.23
0056	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
				56	**Total**	5705.63
0057	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
	Nystatin	1 od	14	14	45.9	642.60
	phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Nystatin	1 od	14	14	45.9	642.60
	Missing			[illegible]	3914.11	3914.11
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Nystatin	1 od	14	14	45.9	642.60
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Metromdazole	2 3 times a day	5	30	5.061	151.83
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				57	**Total**	12736.94

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total cost
0058	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Coartem					4368.00
	Panadol	2 3 times a day	3	18	4.424	79.63
	Missing			1	3914.11	3914.11
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Nystatin	1 od	14	14	45.9	642.60
	FESO4/Folic acid	2 3 times a day	14	84	8.381	704.00
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	metromdazole	2 3 times a day	5	30	5.061	151.83
	Vitamin B complex	2 3 times a day	5-7days	42	2.665	111.93
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
	Magnesium trisillicate	2 3 times a day	7 days	42	3.46	145.32
				58	**Total**	16,788.81
0059	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				59	**Total**	9046.83
0061	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				61	**Total**	4332.71
0064	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
				64	**Total**	5835.66
0065	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Missing			3	3914.11	11,742.33
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				65	**Total**	16228.88

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total Cost
0067	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Flagyl	2 3 times a day	5	30	5.061	151.83
	Metromdozole	2 3 times a day	5	30	5.061	151.83
				67	**Total**	8550.48
0068	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			2	3914.11	7828.22
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				68	**Total**	12721.45
0070	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	B complex	2 3 times a day	5-7days	42	2.665	111.93
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				70	**Total**	5805.17
0071	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3380.75	3380.75
				71	**Total**	7713.46
0073	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
				73	**Total**	8246.82
0074	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				74	**Total**	4893.23
0075	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Griseofulvin	500 mg od	21	21	85.48	1795.08
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				75	**Total**	7081.70

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total Cost
0076	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				76	**Total**	5132.72
0077	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				77	**Total**	4893.23
0078	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				78	**Total**	4893.23
0079	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	B complex	2 3 times a day	5-7days	42	2.665	111.93
	Missing			3	3914.11	11742.33
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Clotrimazole	1 tube	1	1	540	540.00
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Nystatin	1 od	14	14	45.9	642.60
				79	**Total**	19645.39
0080	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Benzathine					
	Paracetamol	2 3 times a day	3	18	4.424	79.63
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Metromdozole	2 3 times a day	5	30	5.061	151.83
				80	**Total**	6544.58
0081	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				81	**Total**	8807.34

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total cost
0082	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Coartem					4368.00
	Amoxyl					800.01
	Phenergan					153.90
	Quinine	600mg (2 tablets)3 times a day for 7 days	7	42	43.627	1832.33
				82	**Total**	11486.95
0086	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			2	3914.11	7828.22
	FES04/folic acid	2 3 times a day	14	84	8.381	704.00
	Multivitamins	2 tablets twice a day	30	120	4.671	560.52
				86	**Total**	13425.45
0087	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
				87	**Total**	8949.76
0088	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	RHEZ					84998.10
	Multivitamins	2 tablets twice a day	30	120	4.671	560.52
				88	**Total**	93,805.54
0090	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				90	**Total**	11434.87
0091	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				91	**Total**	4332.71
0094	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	B-complex					111.93
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				94	**Total**	5244.65

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total quantity	Cost per unit	Total Cost
0096	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
				96	**Total**	4486.61
0097	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				97	**Total**	4332.71
0098	Cotrimoxazole Benzathine	2 tablets a day	183	366	11.838	4332.71
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
				98	**Total**	4486.61
0099	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				99	**Total**	4428.76
0100	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Multivitamins	2 tablets twice a day	30	120	4.671	560.52
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				100	**Total**	10407.36
0103	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Multivitamin					560.52
				103	**Total**	5453.75
0104	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ampiclox	500mg 4 times a day	5 days	20	231	4620.00
	Brufen	2 tablets 3 times a day	3	18	5.716	102.89
	Missing			2	3914.11	7828.22
	Vitamin B complex	2 3 times a day	5-7days	42	2.665	111.93
	B complex	2 3 times a day	5-7days	42	2.665	111.93
	Carbamazepine	200mg once a day or twice a day	7-14 days	14	38.332	536.65
				104	**Total**	17,644.32

Table 1 Rwimi Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Type	Prescription	Number of days	Total pumbit	Cost per unit	Total Cost
0105	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				105	**Total**	5453.75
0106	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				106	**Total**	4332.71
0107	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Missing			2	3914.11	7828.22
	Nystatin	1 od	14	14	45.9	642.60
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Amtriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
				107	**Total**	14904.88
0108	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				108	**Total**	4332.71
0110	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				110	**Total**	6253.76
0112	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Missing			1	3914.11	3914.11
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Metromdazole	2 3 times a day	5	30	5.061	151.83
				112	**Total**	8959.17
0113	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				113	**Total**	4893.23
0115	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Panadol	2 3 times a day	3	18	4.424	79.63
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Nystatin	1 od	14	14	45.9	642.60
				115	**Total**	5854.95
0117	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				117	**Total**	4332.71

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit costs	Total costs
J004	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J004	**Total**	4332.71
J005	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciproflaxin	2 per day	5	10	65.85	658.50
J005	Amoxyl (250 ml)	2 3 times a day	5	30	26.667	800.01
	Ciprofloxacin	2 per day	5	10	65.85	658.50
				J005	**Total**	6449.72
J009	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 twice a day	30	120	4.671	560.52
	Diclofenac	2 3 times a day	3	18	9.09	163.62
	Coartem	4 2 times a day	3	24	214.861111	4368.00
	Ceftriaxone	2 vials everyday	5	10	6784	67840.00
	Clavil	2 3 times a day	5	30	952.55	28576.50
				J009	**Total**	105841.35
J010	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J010	**Total**	4332.71
J011	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J011	**Total**	4332.71
J012	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Pyridoxine	15 mg	7	7	12.205	85.44
	Albendazole	800 mg -once	1	2	48.026	96.05
				J012	**Total**	4514.20

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Costs	Total costs
J018	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J018	**Total**	4332.71
J019	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J019	**Total**	4332.71
J022	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Vitamin B complex	2 3 times a day	5-7days	42	2.665	111.93
	Magnesium Trisillicate	2 3 times a day	7 days	42	3.46	145.32
	Amoxyl(250ml)	2 3 times a day	5	30	26.667	800.01
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amoxyl(250ml)	2 3 times a day	5	30	26.667	800.01
	Ciprofloxacin	2 per day	5	10	65.85	658.50
				J022	**Total**	7506.98
J027	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Piridoxine	15 g	5	75	12.205	915.38
	Diclofenac	50 mg (1 tab) 3 times a day	3	9	9.09	81.81
	Coartem	4 2 times a day	3	24	214.861111	4368.00
	Coldcap	1 cup 3 times a day	3	1		
				J027	**Total**	9697.89

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Costs	Total cost
J029	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
	Loridine	1 2 times	5 days	10		
	Fluconazole	200mg od	30 days	30	297.5	8925.00
	Aciclovir	200mg (1 tab) 5 times a day	7	35	243.01	8505.35
	Fluconazole	200mg od	30 days	30	297.5	8925.00
				J029	**Total**	31487.05
J032	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
	Acyclovir	200mg 5 times a day	7	35	243.01	8505.35
	Amytriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Diclofenac	50 mg (1 tab) 3 times a day	3	9	9.09	81.81
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
	Amytriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Ibubrofen	2 tablets 3 times a day	3	18	5.716	102.89
	Clotrimaxole	1 tube apply for 3 times a day		1	540	540.00
	Griseofulvin	500 mg od	21	21	85.48	1795.08
				J032	**Total**	17220.38

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit cost	Total cost
J038	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	paracetamol	2 3 times a day	3	18	4.424	79.63
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Flagil	2 3 times a day	5	30	5.061	151.83
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Diclofenac	50 mg (1 tab) 3 times a day	3	9	9.09	81.81
	Flagyl	2 3 times a day	5	30	5.061	151.83
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
				J038	**Total**	6352.37
J042	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Panadol	2 3 times a day	3	18	4.424	79.63
				J042	**Total**	4972.86
J043	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amytriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
				J043	**Total**	5171.51
J059	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J059	**Total**	4332.71

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Cost	Total cost
J061	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Iron sulphate/Folic acid	2 3 times a day	14	84	8.381	704.00
				J061	**Total**	5695.21
J064	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Metronidazole (Flagyl)	2 3 times a day	5	30	5.061	151.83
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Multivitamin	2 tablets everyday	30	120	4.671	560.52
	Mebendazole	1oomg od (1 tablet)	1 day	1	4.894	4.89
	Pyridoxine	15 g	7	7	12.205	85.44
	Amitriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Cetrizine	10 mg 2 times a day	7 days	14	50.21	702.94
	Erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
	Piridoxine	15 g	7	7	12.205	85.44
				J064	**Total**	9150.61
J065	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Paracetamol	2 3 times a day	3	18	4.424	79.63
				J065	**Total**	5870.85

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit cost	Total cost
J069	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
				J069	**Total**	5649.71
J071	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Aciclovir	200mg 5 times a day	7	35	243.01	8505.35
	Tetracycline	1 tube			334	334.00
J071	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Paracetamol	2 3 times a day	3	18	4.424	79.63
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
				J071	**Total**	14515.15
J073	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
	Diflucan	200mg od	30 days	30	297.5	8925.00
				J073	**Total**	13960.65
J079	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Flagyl	2 3 times a day	5	30	5.061	151.83
	Coartem	4 2 times a day	3	24	214.861111	4368.00
				J079	**Total**	8852.54
J083	Cotrimozaxole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
				J083	**Total**	4893.23

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Drugs	Standard prescription	Number of days	Total quantity	Unit Cost	Total cost
J092	Cotrimozaxole	2 tablets a day 2 tablets twice a day	183	366	11.838	4332.71
	Multivitamin	25 mg (1 tab) at night od	30	120	4.671	560.52
	Amitriptyline	200mg 5 times a day	7-14 days	14	12.879	180.31
	Aciclovir		7	35	243.01	8505.35
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Ciprofloxacin	1 two times a day 1 two times a day	5	10	65.85	658.50
	Ciprofloxacin		5	10	65.85	658.50
	RHEZ/EH		60 180			84998.10
	RHEZ	Continued from above	60			
	EH	Continued from above	180			
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Panadol	2 3 times a day	3	18	4.424	79.63
				J092	**Total**	101,334.15
J093	Cotrimoxazole	2 tablets a day 2 tablets twice a day	183	366	11.838	4332.71
	Multivitamin		30	120	4.671	560.52
	Erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
	Vitamin E	1 everyday for 7-14 days	14	14		
	Vitamin B-6	15 g	5	75	12.205	915.38
	Erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
	mebendazole	100mg od (1 tablet)	1 day	1	4.894	4.89
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
				J093	**Total**	13551.04

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	[illegible]	Standard prescription	Number of days	Total quantity	[illegible] unit	[illegible] cost
J095	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.708
	Nystatin pessaries	1 od	14	14	45.9	642.6
	erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
				[illegible]	[illegible]	7363.348

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Costs	Total costs
J098	Cotrimoxazole	2 tablets a day 1 two times a day	183	366	11.838	4332.71
	Ciprofloxacin	2 tablets twice a day	5	10	65.85	658.50
	Multivitamin		30	120	4.671	560.52
	Amoxyl	2 3 times a day	5	30	26.667	800.01
				J098	**Total**	6351.74
J103	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J103	**Total**	4332.71
J104	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Vitamin A	200 international unit only once	1	1	59.248	59.25
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
	Amoxyclov-clavil	2 3 times a day	5	30	952.55	28576.50
				J104	**Total**	34231.92
J107	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Pyridoxine	15 g	7	7	12.205	85.44
	Amitriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Petroconazole	200 mg once a day	7			
	Neuroubin	2 2 times a day	7	28	2.665	74.62
	Fluconazole	200mg od	30 days	30	297.5	8925.00
				J107	**Total**	14158.59

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Cost	Total cost
J115	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Piridoxine	15 g	5	75	12.205	915.38
	Iron sulphate/folic acid	2 3 times a day	14	84	8.381	704.00
	Fluconazole	200mg od	30 days	30	297.5	8925.00
	Fluconazole	200mg od	30 days	30	297.5	8925.00
	Piridoxine	15 g	7	7	12.205	85.44
	Calamine lotion	bottle	1	1	909	909.00
	Aciclovir	200mg 5 times a day	7	35	243.01	8505.35
	Amytriptylinne	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Ibuprofen	2 tablets 3 times a day	3	18	5.716	102.89
				J115	**Total**	33585.07
J117	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Acyclovir	200mg 5 times a day	7	35	243.01	8505.35
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Clotrimazole	1 tube	1	1	540	540.00
				J117	**Total**	14499.10
J130	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
				J130	**Total**	4332.71
J133	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ketoconazole	200mg od (1 tablet)	7	7	102.06	714.42
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Cetrizine	10 mg 2 times a day	7	14	50.21	98.00
				J133	**Total**	7110.60

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Costs	Total costs
J136	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Metronidazole	2 3 times a day	5	30	5.061	151.83
	Ampiclox	500mg 4 times a day	5 days	20	231	4620.00
	Doxycycline	2 times for 7 days	7	14	27	378.00
	Nystatin	1 od	14	14	45.9	642.60
	Fluconazole	200mg od	30 days	30	297.5	8925.00
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Flagyl	2 3 times a day	5	30	5.061	151.83
	Doxycycline	2 times for 7 days	7	14	27	378.00
	Griseofulvin	500 mg od	21	21	85.48	1795.08
	Panadol	2 3 times a day	3	18	4.424	79.63
	Griseofulvin	500 mg od	21	21	85.48	1795.08
				J136	**Total**	24566.76
J138	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Metronidazole	2 3 times a day	5	30	5.061	151.83
	Ketoconazole	200mg od (1 tablet)	7	7	102.06	714.42
	Diclofenac	50 mg (1 tab) 3 times a day	3	9	9.09	81.81
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Phenergan	25 ml 3 times a day	5 days	15	10.26	153.90
	Coartem	4 2 times a day	3	24	214.861111	4368.00
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Ampiclox	500mg 4 times a day	5 days	20	231	4620.00
				J138	**Total**	18640.79

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit cost	Total cost
J146	Cotrimoxazole	2 tablets a day 100mg od (1 tablet)	183	366	11.838	4332.71
	Mebendazole		1 day	1	4.894	4.89
	Metronidazole	2 3 times a day	5	30	5.061	151.83
				J146	**Total**	4489.43
J147	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Cabamazyne	200mg once a day or twice a day	7-14 days	28	38.332	1073.30
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
	Amytriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Clotrimazole	1 tube		1	540	540.00
				J147	**Total**	7471.85
J152	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Doxycycline	2 times for 7 days	7	14	27	378.00
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Quinin	600mg (2 tablets)3 times a day for 7 days	7	42	43.627	1832.33
	Paracetamol	2 3 times a day	3	18	4.424	79.63
				J152	**Total**	8125.62
J157	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Coartem	4 2 times a day	3	24	214.861111	4368.00
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
				J157	**Total**	10862.16

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Cost	Total cost
J158	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Erythromycin	500mg (2 tablets) 4 times a day	5 days	40	59.701	2388.04
	Coartem	4 2 times a day	3	24	214.86111 1	4368.00
	FESO4/Folic Acid	2 3 times a day	14	84	8.381	704.00
	Aciclovir	200mg 5 times a day	7	35	243.01	8505.35
	RHEZ		60			84998.10
	EH		180			
				J158	**Total**	106,096.21
J159	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Nystatin	1 od	14	14	45.9	642.60
	Onmetrazole					
	Amoxyl	2 3 times a day	5	30	26.667	800.01
	Flagyl	2 3 times a day	5	30	5.061	151.83
	Albendazole	800 mg od (2 of 400 mg)	1 time	2	48.026	96.05
				J159	**Total**	6023.20
J164	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Piridoxine	15 g	7	7	12.205	85.44
	Coartem	4 2 times a day	3	24	214.86111 1	4368.00
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Coartem	4 2 times a day	3	24	214.86111 1	4368.00
	Ciprofloxacin	1 two times a day	5	10	65.85	658.50
	Pyridoxine	15 g	7	7	12.205	85.44
	Amytriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Teratcycline eye ointment	1 tube		1	334	334.00
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Workeine	1 bottle- 100 ml				
				J164	**Total**	16752.44

Table 2 JCRC Cohort: Valuation of Non-ARV Drugs (continued)

Patient Number	Types	Standard prescription	Number of days	Total quantity	Unit Cost	Total costs
J169	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
	Vitamin B complex-neurobin	2 2 times a day	7	28	2.665	74.62
		500mg (2 tablets) 4 times a day				
	Erythromycin		5 days	40	59.701	2388.04
	Metronidazole	2 3 times a day	5	30	5.061	151.83
	Cetrizine	10 mg 2 times a day	7	14	50.21	702.94
				J169	**Total**	7650.14
J180	Cotrimoxazole	2 tablets a day	183	366	11.838	4332.71
		2 tablets twice a day				
	Multivitamin		30	120	4.671	560.52
	Nystatin	1 od	14	14	45.9	642.60
	Multivitamin	2 tablets twice a day	30	120	4.671	560.52
	Amitriptyline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
	Gentamycine	80 mg twice a day	5	10	102	1020.00
	Panadol	2 3 times a day	3	18	4.424	79.63
	Amitripyilline	25 mg (1 tab) at night od	7-14 days	14	12.879	180.31
				J180	**Total**	7556.59

APPENDIX G

Medical and Clinical Staff Cost

Staff Type	Costs (USh)
Clinical Officers	420,000
Registered Nurses	400,000
Enrolled Nurses	300,000
Nursing Assistant	140,000
Health Assistant	280,000
Health Information Officer	240,000
Support Staff	20,000

Source: Personal Communication, Community-Based Staff Project, October 8, 2007